Application For
PSCW Certificate of Public Convenience and Necessity
and
WDNR Utility Permit

Cardinal-Hickory Creek Transmission Line Project

PSCW Docket No. 5-CE-146

April 2018

SECTION **PAGE**

ACOE	Army Corps of Engineers
ACSR	Aluminum Conductor Steel Reinforced
AM	AM broadcast facility
AIS	Agricultural Impact Statement
ASNRI	Areas of Special Natural Resource Interest
APE	Area of Potential Effects
ATC	American Transmission Company
BNHC	Bureau of Natural Heritage Conservation
BMPs	Best Management Practices
CELL	Cellular facility
CPCN	Certificate of Public Convenience and Necessity
CTH	County Highway
Commission	Public Service Commission of Wisconsin
CWA	Clean Water Act
DATCP	Department of Agriculture, Trade and Consumer Protection
Dbh	diameter at breast height
EMF	Electromagnetic Field
ER	Endangered Resource
ERW	Exceptional Resource Water
EIS	Environmental Impact Statement
FAA	Federal Aviation Administration
FERC	Federal Energy Regulatory Commission
FM	FM broadcast facility
FPP	Farmland Preservation Program
FCC	Federal Communications Commission
FCL	Forest Crop Law
GIS	Geographic Information Systems
GW	Gigawatt
IUB	Iowa Utilities Board
kcmil	Kilo circular mils
kV	Kilovolt
MFL	Managed Forest Land
MISO	Midcontinent Independent System Operator, Inc.
MTEP	MISO Transmission Expansion Plan
MVA	Megavolt amperes

MVP	Multi-Value Project
MW	Megawatt
NAIP	National Agriculture Imagery Program
NEPA	National Environmental Policy Act
NHI	Wisconsin Natural Heritage Inventory
NPH	Notice of Presumed Hazard (FAA)
NPS	National Park Service
OHWM	Ordinary High Water Mark
OPGW	Optical ground wire
OSHA	Occupational Safety and Health Administration
ORW	Outstanding Resource Water
PSCW	Public Service Commission of Wisconsin (Commission)
RFI	Radio Frequency Interference
ROW	Right-of-way
RUS	Rural Utilities Service
STH	Wisconsin State Highway
TCSB	Temporary clear span bridge
UMTDI	Upper Midwest Transmission Development Initiative
UNT	Un-named tributary
USFWS	United States Fish and Wildlife Service
USH	United States Highway
WisDOT	Wisconsin Department of Transportation
WISP	Wireless Internet Service Provider
WDNR	Wisconsin Department of Natural Resources
WPDES	Wisconsin Pollutant Elimination Discharge Elimination System
WWI	Wisconsin Wetland Inventory

EXECUTIVE SUMMARY

A. Introduction

American Transmission LLC, by its corporate manager, ATC Management Inc., (collectively ATC), ITC Midwest LLC (ITC Midwest), and Dairyland Power Cooperative (Dairyland), together the Applicants, are proposing to construct a new 345 kV transmission line from the Cardinal Substation in Dane County, Wisconsin, to the Hickory Creek Substation in Dubuque County, Iowa, and connecting to a new intermediate substation to be constructed in Grant County, Wisconsin. The project, known as the Cardinal-Hickory Creek Transmission Line Project (Project), will:

- Provide net economic benefits to Wisconsin customers (even after accounting for the Project's cost to Wisconsin customers) of between $23.5 million and $350.1 million over its 40-year expected life;
- Avoid the need to spend between $87.2 million and $98.8 million on reliability projects and asset renewal projects over the 40-year life of the Project that would have otherwise been needed if the Project was not constructed;
- Increase the transfer capability of the electric system between Iowa and southwest and southcentral Wisconsin by approximately 1,300 MW, thereby easing congestion, increasing competition and allowing the transfer of additional low-cost wind energy into the state;
- Provide an outlet for approximately 25 GW of wind resources in Iowa and areas west of Wisconsin including some that are owned by Wisconsin utilities;
- Allow more than a dozen new wind facilities to fully interconnect to the electric system in areas west of Wisconsin;
- Eliminate the need for three transmission system Operating Guides in southwest and southcentral Wisconsin, which currently require load shedding and/or other operational actions under certain contingencies due to reliability concerns in the area; and
- Create other reliability and public policy benefits stemming from a more robust and flexible electric transmission system in the state.

Multiple study efforts beginning in 2008 identified the Project as a necessary facility to ensure a reliable and efficient electric grid that keeps pace with energy demands and public policy objectives. In 2011, the Midcontinent Independent System Operator, Inc. (MISO), a regional transmission organization, approved this Project in its MISO Transmission Expansion Plan (MTEP). Specifically, in the 2011 MTEP, MISO designated and approved a portfolio of 17 Multi-Value Projects (MVP Portfolio), including this Project, designed to create an interstate backbone system to reliably and cost-effectively deliver renewable energy, primarily from high wind resource areas in the west and Midwest, to population centers to the east. Upon approval in MTEP Appendix A, the owners of the projects in the MVP Portfolio were then obligated "to make a good faith effort to design, certify, and build the designated facilities to fulfill the approved MTEP."[1]

The Project requires a Certificate of Public Convenience and Necessity (CPCN) from the Public Service Commission of Wisconsin (PSCW or Commission) and a Utility Permit from the Wisconsin Department of Natural Resources (WDNR) for the transmission line, substation, and related facilities in Wisconsin. In this Application, the Applicants seek approval from the Commission and the WDNR to construct the Project along one of the two proposed routes located in the following counties: Dane, Iowa, Lafayette and Grant. This executive summary provides an overview of the proposal and identifies where detailed information can be found in the Application.

B. Facilities to be Constructed

The major facilities in Wisconsin the Applicants propose to construct and place in operation include the following:

- A new 345 kV/138 kV intermediate substation, to be called Hill Valley, located in the town of Wingville, near the village of Montfort;
- A new 34 mile to 52 mile (depending on the route chosen) 345 kV transmission line from a crossing of the Mississippi River in the village of Cassville to the new Hill Valley Substation;
- A new 50 mile to 53 mile (depending on the route chosen) 345 kV transmission line from the new Hill Valley Substation to the Cardinal Substation in the town of Middleton;
- A new 138 kV interconnection of Hill Valley Substation and the existing Nelson Dewey to Eden 138 kV transmission line (X-16);
- Modifications at the Eden Substation in the town of Eden to increase transmission line and bus ratings;
- Modifications at the Stoneman Substation in the village of Cassville to support the removal of one or more transmission lines depending on the Mississippi River crossing location;
- A new 161 kV terminal within the Nelson Dewey Substation (depending on the Mississippi River crossing location) and related modifications;
- A new 345 kV terminal within the Cardinal Substation; and
- Ground grid improvements at the Wyoming Valley Substation in the town of Wyoming.

A majority of the transmission line structures will be self-supporting steel monopoles. The structure heights will typically range from 120 to 175 feet with the spans generally ranging from

[1] MISO's Attachment FF, Transmission Expansion Planning Protocol, 60.0.0.

750 to 1,100 feet depending on the specific location and transmission line configuration. The typical right-of-way (ROW) will be 150-feet wide.

Detailed information regarding structure types and ROW width is in **Section 5.3** and Appendix C. Additional details related to required substation modifications are located in **Section 5.8**.

ITC Midwest and Dairyland will, subject to any required governmental and regulatory approvals, construct related facilities in Iowa and crossing the Mississippi River to Wisconsin. These facilities include the following:

- A new 345 kV terminal within the existing Hickory Creek Substation in Dubuque County, Iowa;
- The new, approximately 14-mile long, 345 kV Cardinal-Hickory Creek transmission line from the Hickory Creek Substation crossing Mississippi River in Clayton County, Iowa to Wisconsin. A portion of the 345 kV line will be double circuited with the existing Dairyland 161 kV transmission line presently crossing the river;
- Removal of the Dairyland 69 kV transmission line from the Stoneman Substation crossing the Mississippi River to a point near the Turkey River Substation in Dubuque County, Iowa. This removed transmission line section will be replaced by a new short (less than 1 mile) Dairyland 69 kV line that will connect the remaining 69 kV transmission line into the Turkey River Substation; and
- Rebuilding the Turkey River Substation to reconfigure the substation with two 161/69 kV transformers, four 161 kV circuit breakers, and five 69 kV circuit breakers.

C. Purpose and Necessity

The Project will provide substantial net economic, reliability and public policy benefits to Wisconsin, Iowa, and the region. It will also provide much-needed flexibility for the regional transmission system to respond to the ever-changing energy markets and generation portfolios.

In December 2011, after a comprehensive planning analysis, the MISO Board of Directors approved a portfolio of projects under its Multi-Value Project (MVP) Tariff that included the Project. To be included in this MVP portfolio, a project had to meet rigorous MISO criteria and provide regional economic, reliability and public policy benefits. Importantly, MVP costs are shared across the region, and the board's approval of the portfolio required the "transmission owners to use due diligence to construct the facilities approved in the plan." As such, although the Project will cost approximately \$492M to \$543M to construct, depending on the final route chosen, as a result of the MISO cost allocation, Wisconsin customers will only pay approximately \$66M to \$72M for the Project.

In preparing this Application, the Applicants evaluated the Project from a more Wisconsin-specific perspective. More specifically, the Applicants evaluated how the following alternatives would impact Wisconsin from an economic, reliability, and public policy perspective: the Project, a No-Action Alternative, a Low-Voltage Alternative, and a Non-Transmission Alternative. Based on the joint planning analyses contained in this Application, the Applicants have concluded that the Project is superior to the other alternatives. If constructed, the Project will:

- Lower wholesale energy costs;
- Reduce losses on the transmission system creating a more efficient transmission system and reducing the amount of energy that needs to be generated to meet consumer requirements;
- Avoid the need for and cost of reliability and other future system maintenance projects that would otherwise have to be built in Wisconsin;
- Facilitate the transfer of additional, lower-cost wind energy into Wisconsin;
- Reduce congestion on the transmission system by increasing transfer capability between Iowa and Wisconsin by approximately 1,300 MW; and
- Enhance reliability and load-serving support in southwest and southcentral Wisconsin.

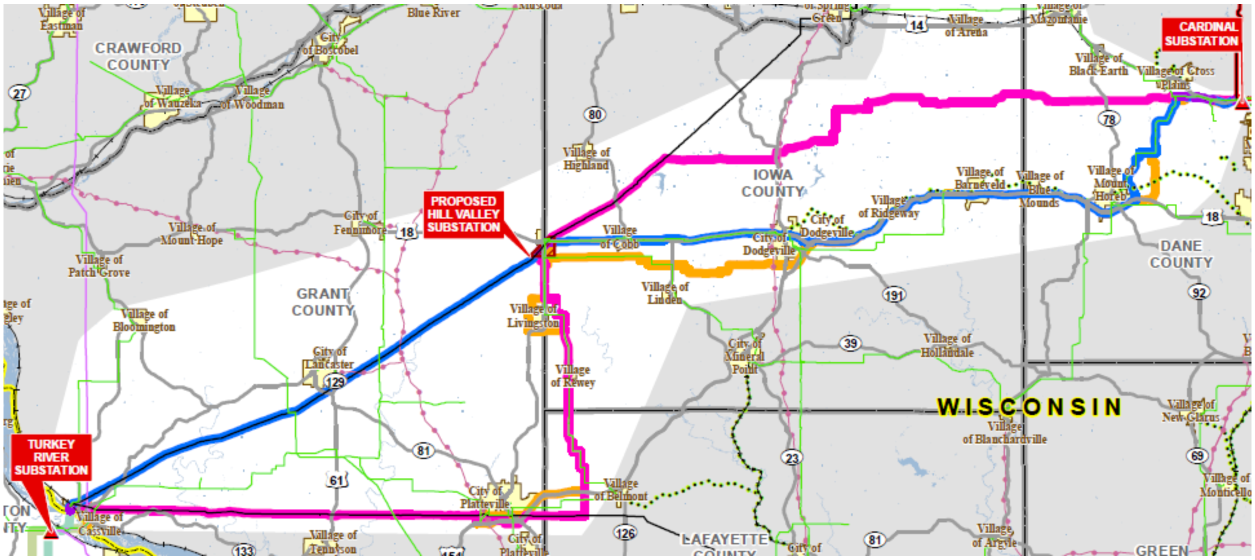
When compared to the No-Action, Low Voltage and Non-Transmission alternatives, the Project provides the greatest total net benefit to Wisconsin customers and these benefits are reasonable in relation to the cost of the high-voltage transmission line. With this filing, the Applicants therefore seek approval from the PSCW for the necessary regulatory authorizations required to construct the Project and place its facilities in-service. Numerous other studies both corroborate the Applicants' conclusions and demonstrate that the Project provides additional benefits to regional customers.

The Applicants' detailed need analyses are contained in **Section 2** and **Appendix D, Exhibit 1**.

D. Proposed Routes

The Applicants have developed a Preferred Route and an Alternate Route for the 345 kV transmission line from the Mississippi River crossing in the village of Cassville to the new Hill Valley Substation near the village of Montfort, and from the new Hill Valley Substation to the Cardinal Substation in the Town of Middleton. The route alternatives are shown below and in **Appendix A, Figure 1** of this Application.

Cardinal-Hickory Creek Route Alternatives



a. Route Segments

<u>Mississippi River Crossing to the Hill Valley Substation</u>

The Preferred Route, shown in blue above, is approximately 34 miles in length and passes through Grant County.

The Alternate Route, shown in pink above, is approximately 52 miles in length and passes through Grant, Lafayette, and Iowa counties.

<u>Hill Valley Substation to Cardinal Substation</u>

The Preferred Route is approximately 53 miles in length and the Alternate Route is approximately 50.3 miles in length. Both routes pass through Grant, Iowa, and Dane counties.

b. Route Preference

The Preferred and Alternate Routes proposed in this Application are superior to all of the other route variations the Applicants evaluated as part of their routing and siting process. This process included evaluating 890 miles of corridors comprised of more than 500 segments, including: electric transmission lines, roads and highways, railroads, gas pipelines, recreational trails, and new right-of-way.

When compared to each other, the Applicants' Preferred Route would be shorter than the Alternate Route (87 miles compared to 102 miles) and shares more existing infrastructure ROW by area (42 percent to 26 percent) and by length (95 percent to 63 percent). The Preferred Route better meets the routing priorities defined by Wisconsin statute, impacts fewer agricultural acres and creates fewer new impacts to woodlands and wetlands. The Applicants' Preferred Route would also have a lower capital cost than the Alternate Route ($492M compared to $543M) and a lower overall cost impact to Wisconsin customers ($66M compared to $72M).

From the Mississippi River crossing to the Hill Valley Substation, the Applicants' Preferred Route would follow existing ROW for approximately 99 percent of its length and would share 34 percent of its acreage with existing ROWs. The Alternate Route from the Mississippi River crossing to Hill Valley Substation would follow existing ROW for approximately 91 percent of its length and would share 33 percent of its acreage with existing ROW. The difference between the percentage of the route following existing ROW versus the percentage of acreage shared with existing ROW is primarily due to the need to build the Project offset from existing transmission line corridors as discussed in **Section 1.8.2**.

Similarly, from the Hill Valley Substation to the Cardinal Substation, the Applicants' Preferred Route would follow existing ROW for approximately 57 percent of its length and would share 47 percent of its acreage with existing ROW. The Alternate Route from the Hill Valley Substation to Cardinal Substation would follow existing ROW for approximately 34 percent of its length and would share 18 percent of its acreage with existing ROW.

c. Route Development Process

To identify the routes proposed in this Joint Application, the Applicants used a multi-stage process following the transmission line siting priorities established by the state of Wisconsin that involved consulting with the PSCW, the WDNR, the Wisconsin Department of Transportation (WisDOT), the Department of Agriculture Trade and Consumer Protection (DATCP), and conducting an extensive public participation process.

The siting priorities law is set forth in Wis. Stat. § 1.12(6) and provides that when siting new transmission lines, routing priorities are to be used consistent with economic and engineering considerations, reliability of the electric transmission system, and protection of the environment. The routing priorities in order of priority are:

a. Existing utility corridors;

b. Highway and railroad corridors;

c. Recreational trails to the extent the facilities may be constructed below ground and do not significantly impact environmentally sensitive areas; and

d. New corridors.

Accordingly, when developing the routes for and design of the Project, the Applicants sought to use existing rights-of-way "to the extent practicable" and so that "the routing and design of the high-voltage transmission line minimizes environmental impacts in a manner that is consistent with achieving reasonable electric rates." Wis. Stat. 196.491(3)(d)3r.

In total, as part of the routing and siting process, the Applicants conducted two rounds of public open houses attended by approximately 1,300 people, sent multiple mailings to property owners in the Project area, considered hundreds of comments from the public, stakeholders, and municipalities, and met dozens of times with state and federal agencies. The Applicants also gathered data on existing land uses and environmental features from databases, GIS data, and field observations. The Applicants used all of this information to help guide the selection of the Proposed and Alternate routes that they have proposed in this Application.

E. Project Cost

The total Project cost, including the portions that will be paid for by the entire MISO region, is between $492M and $543M, depending on the route chosen for the transmission line, but the entire cost will not be borne by Wisconsin customers.

If the Project is approved, Wisconsin customers will only pay for approximately $66M to $72M of the total Project costs (depending on the route chosen); the rest of the Project's costs will be shared by the rest of the MISO region. As explained in more detail in **Section 2**, this is because MISO has included the Project in its MVP portfolio.

F. Regulatory Approvals

In Wisconsin, in addition to the CPCN and the Utility Permit, the Project will require a number of approvals and permits from federal and state agencies and units of government. A list of these permits is contained in **Section 1.6**.

Because part of the Project is located in Iowa, the Iowa Utilities Board (IUB) will also need to approve the construction of that portion of the Project after considering whether the project is necessary to serve a public use, represents a reasonable relationship to an overall plan of transmitting electricity in the public interest, and meets all other legal requirements. Iowa Code Section 478.1(5).

The Rural Utilities Service, with the cooperation of the U.S. Fish and Wildlife Service (USFWS) and the U.S. Army Corps of Engineers (ACOE), is currently conducting an environmental review of the Project and will conclude with its review by issuing a Final Environmental Impact Statement and Record of Decision.

G. Construction Schedule

The Applicants anticipate commencing substation construction in October 2020 and transmission line construction in October 2021. The Applicants anticipate placing the transmission line and substation in service in December 2023.

H. Conclusion

Based on the material contained and referenced in this Joint Application and any subsequent material requested by the PSCW or WDNR related to this Joint Application, the Applicants request that the PSCW issue a CPCN and any other necessary approvals authorizing the construction of the transmission facilities as described herein and in the manner set forth. The Applicants also request that WDNR issue all the permits and authorizations that may be required to construct the transmission facilities in the manner described in this Application within 30 days after the PSCW issues its decision on the Application.

APPLICATION FOR PSCW CERTIFICATE OF PUBLIC CONVENIENCE AND NECESSITY AND WDNR UTILITY PERMIT[2]

1.0 PROJECT OVERVIEW

1.1 Owners and Investors

The owners of the Project are:

- ATC, with its principal place of business located at W234 N2000 Ridgeview Parkway Court, Waukesha, Wisconsin 53188;
- ITC Midwest, with its principal place of business located at 123 5th Street SE, Cedar Rapids Iowa 52401; and
- Dairyland, with its principal place of business located at 3200 East Avenue South, La Crosse, Wisconsin 54601, are proposing to construct the Project.

ATC and ITC Midwest are transmission companies with the sole purpose of planning, constructing, operating, and maintaining transmission facilities that provide electric transmission service. Dairyland is a not-for-profit generation and transmission electric cooperative owned by, and providing the wholesale power requirements for, 24 separate distribution cooperatives in southern Minnesota, western Wisconsin, northern Iowa, and northern Illinois. Dairyland also provides the wholesale power requirements for 17 municipal utility members.

ATC, ITC Midwest, and Dairyland expect to divide ownership of the proposed 345 kV transmission line as follows: ATC 45.5%; ITC Midwest 45.5%; and Dairyland 9%. Regarding the work at the substations associated with the Project, ATC will own the new Hill Valley Substation and currently owns the Cardinal, Eden, Nelson Dewey, and Wyoming Valley substations. ITC Midwest owns the Hickory Creek and Turkey River substations (both located in Iowa). Dairyland owns the Stoneman Substation.

1.2 Agreements

The Applicants have not entered into any contractual agreements related to this Project with any developer to construct, finance, lease, use, or own transmission facilities.

1.3 Project location and endpoints

The Project will extend from the Cardinal Substation in Dane County, Wisconsin, to the Hickory Creek Substation in Dubuque County, Iowa. The Project will connect to a new mid-point

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[2] This Application was prepared in accordance with the PSCW and WDNR *Application Filing Requirements Transmission Line Projects*, Version October 2017, and the *Application Filing Requirements Substation Projects*, Version October 2017 (collectively referred to as the Application Filing Requirements).

substation to be constructed in Grant County, the Hill Valley Substation. Construction would occur in Grant, Iowa, Dane and Lafayette counties depending on the route chosen.

1.4 Impacted Cities, Villages, and Townships

Depending on the route chosen, the Project will impact the cities, villages, and townships shown in Table 1.4-1 and 1.4-2 below.

Table 1.4-1 Impacted Cities, Villages and Townships – Preferred and Alternate Routes

County	Municipality	
	Preferred Route	**Alternate Route**
Dane	Town of Blue Mounds Town of Cross Plains Town of Middleton Town of Springdale Village of Blue Mounds Village of Mount Horeb	Town of Cross Plains Town of Middleton Town of Vermont
Grant	Town of Beetown Town of Cassville Town of Clifton Town of Ellenboro Town of Liberty Town of South Lancaster Town of Waterloo Town of Wingville Village of Cassville Village of Montfort	Town of Clifton Town of Harrison Town of Platteville Town of Potosi Village of Cassville Village of Montfort
Iowa	Town of Brigham Town of Dodgeville Town of Eden Town of Highland Town of Linden Town of Ridgeway City of Dodgeville Village of Barneveld Village of Cobb Village of Ridgeway	Town of Arena Town of Dodgeville Town of Eden Town of Highland Town of Mifflin Town of Wyoming Village of Rewey
Lafayette		Town of Belmont Town of Elk Grove

Additionally, the following cities, towns and villages are impacted by “Other” Route Segments being carried forward in the federal Environmental Impact Statement being prepared for the Project.[3]

Table 1.4-2 Potentially Impacted Cities, Villages and Townships – Other Route Segments

County	Municipality
	Other Route Segments
Dane	Town of Cross Plains Town of Middleton Town of Springdale
Grant	Town of Cassville Town of Clifton Town of Platteville Town of Wingville City of Platteville Village of Cassville Village of Livingston
Iowa	Town of Brigham Town of Dodgeville Town of Eden Town of Linden Town of Mifflin Village of Barneveld City of Dodgeville
Lafayette	Town of Belmont

1.5 PSCW Review

1.5.1 Type of Application

Pursuant to the requirements of Wis. Stat. §§ 1.11, 1.12, 196.025, 196.49 and 196.491, and Wis. Admin. Code chs. PSC 4, 111 and 112, the Applicants are applying to the Commission for a CPCN and any other authorization needed to construct the proposed Project as set forth in further detail below.

In addition to applying for a CPCN, through this Application and pursuant to Wis. Stat. ch. 283 and §§ 30.025(1s), 30.19, 30.123, and 281.36, and Wis. Admin. Code chs. NR 103, 216, 299, and 320, the Applicants are also applying to the Wisconsin Department of Natural Resources

[3] As part of the federal EIS, RUS is examining the Applicants' proposed routes and several alternative route segments referred to as the "Other" route segments in this Application.

(WDNR) for a Utility Permit. The complete list of WDNR permits and authorizations necessary to construct the Project are listed in Section 8.

By this filing, the Applicants are confirming their understanding that through the pre-application process provided for in Wis. Stat. § 30.025(1m), the WDNR, the PSCW, and the Applicants have conferred and made a preliminary assessment of the Project's scope and alternatives and Applicants have identified potentially interested persons. The Applicants have also been made aware, in accordance with Wis. Stat. §§ 30.025(1m)(b) & (c), of the information that they are required to provide and the required timing for the information submissions.

1.5.2 Type of Commission Action

The Project is categorized as a Type 1 action pursuant to Wis. Admin. Code § PSC 4.10. Information necessary for the initial preparation of an Environmental Impact Statement is provided as part of this Application.

1.5.3 CPCN Exemption

This Project does not qualify for a CPCN exemption under Wis. Stat. §196.491(4)(c)1m.

1.5.4 Expedited Review

The Applicants are not seeking an expedited review of the Project.

1.6 Project Details and Project Area Information

1.6.1 Location of route(s) and associated facilities

The Applicants propose constructing and placing in operation the following facilities in Wisconsin:

- A new 345 kV/138 kV intermediate substation, to be called Hill Valley, located in the town of Wingville, near the village of Montfort;
- A new 34 mile to 52 mile (depending on the route chosen) 345 kV transmission line from a crossing of the Mississippi River in the village of Cassville, to the new Hill Valley Substation;
- A new 50 mile to 53 mile (depending on the route chosen) transmission line from the Hill Valley Substation to the Cardinal Substation in the town of Middleton;
- A new 138 kV interconnection of Hill Valley Substation and existing 138 kV transmission line X-16;
- Modifications at the Eden Substation in the town of Eden to increase transmission line and bus ratings;
- Modifications at Stoneman Substation in the village of Cassville to support the removal of one or more transmissions lines depending on the Mississippi River crossing location and the Wisconsin portion of Dairyland's 161 kV and 69 kV transmission lines;
- A new 161 kV terminal within the Nelson Dewey Substation (depending on the Mississippi River crossing location) and related modifications;

- A new 345 kV terminal within the Cardinal Substation located in the town of Middleton; and,
- Ground grid improvements at the Wyoming Valley Substation in the town of Wyoming.

1.6.2 Footprints of associated facilities

The physical location and layout of each substation the Project impacts are provided in Appendix C. Detailed information regarding the work to be performed at each substation is provided in Section 5.8.

The Applicants propose to construct the new Hill Valley Substation on an 80-acre parcel in the town of Wingville, Grant County. An alternative substation location, situated on an 80-acre parcel in the Town of Eden, Iowa County, was selected by the Rural Utilities Service (RUS) to carry forward in the federal Environmental Impact Statement being prepared for the Project. The location of the new substation depends on the site selected by the Commission. The substation and related facilities area will occupy approximately 22 of the 80 acres.

The Cardinal Substation is in the town of Middleton, Dane County. No additional property or substation fence expansion is needed for this Project.

The Eden Substation is in the town of Eden, Iowa County. No additional property or substation fence expansion is needed for this Project.

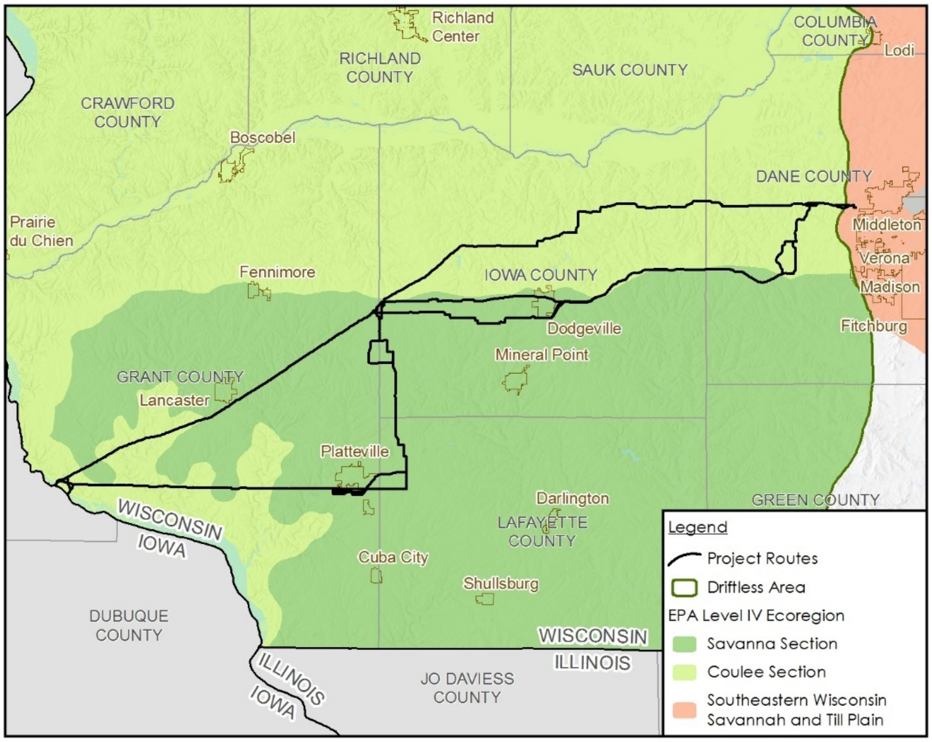
The Nelson Dewey Substation is in the village of Cassville, Grant County. No additional property or substation fence expansion is needed for this Project.

The Stoneman Substation is in the village of Cassville, Grant County. No additional property or substation fence expansion is needed for this Project.

The Wyoming Valley Substation is in the town of Wyoming, Iowa County. No additional property or substation fence expansion is need for this Project.

1.6.3 Generalized Geology, Topography, Land Cover and Land Use

The Project is located mostly within the Wisconsin Driftless Area of the Central Lowland Physiographic province. This area is characterized as unglaciated terrain dominated by sedimentary formations of mostly dolomite and sandstone. The topography of the area has been impacted by erosion by dissecting river valleys and tributaries to the Mississippi River.



Most of the Project crosses through the Savanna and Coulee sections of the Driftless Area ecoregion, which are grouped by similarities in ecosystems, landforms, and natural resources. The Coulee Section is crossed by the southwestern portion of the Project Area along the Mississippi River and the northeastern portion of the Project Area in northern Iowa County and northwestern Dane County. This section is characterized by steeply dissected slopes and hills and relatively broad valleys. Land use within this region is predominantly a mixture of agriculture and woodland, with rural residences scattered throughout. The potential natural vegetation of this region is prairie, and large stands of mixed deciduous forests. Oaks (*Quercus* spp.), sugar maple (*Acer saccharum*) and basswood (*Tilia americana*) are common, especially on steeper slopes. Many of the flatter valleys and ridges have been converted to agricultural uses, while wetlands frequently occur along the rivers and streams.

Much of the central portion of the Project passes through the Savanna Section of the Driftless Area ecoregion, characterized by broad, level ridge tops and narrow, steep-sided valleys with southern-flowing streams. Land use within this region is a mixture of cropland and pasture, interspersed with small areas of woodland and scattered residences. The potential natural vegetation of this region is a mosaic of oak forests, savannas, and prairie.

The eastern terminus of the Project Area occurs in the Southeastern Wisconsin Savanna and Till Plain Ecoregion, a glaciated region with gently rolling terrain, which supports a mosaic of agricultural areas, small woodlots, and wetlands. The potential natural vegetation of this area is oak forests, oak savanna, prairie, and sedge meadows. Most of the original vegetation has been converted to agriculture, with rural residences common throughout this area.

1.6.4 Special or Unique Natural or Cultural Resources

The following summarizes some of the special or unique natural resources within the Project Area. Most of these features are addressed in more detail in other sections of this Application.

The Project crosses several special or unique natural resources common to both the Preferred and Alternate routes, including:

- The Mississippi River and Upper Mississippi River National Wildlife and Fish Refuge;
- The Southwest Wisconsin Grassland and Stream Conservation Area;
- The Black Earth Creek Wildlife Area – Sunnyside Unit (Dane County Parks);
- The Black Earth Creek, an Outstanding Resource Water (ORW);
- Important Bird Areas (IBAs), which are designated by the WDNR, including the Military Ridge-York Prairie and the Pecatonica River IBAs; and
- Several Exceptional Resource Waters (ERW) and trout streams as identified in Section 6.5 (Waterways).

In addition to the common features listed above, the Preferred Route crosses the Military Ridge Trail and the Alternate Route crosses:

- The Blackhawk Lake Recreation Area and an adjacent Cobb-Highland Commission property.

1.6.5 Areas of Residential Concentrations and Urban Centers

The Preferred Route would border residential concentrations along Highway 14 in the towns of Middleton and Cross Plains and along Highway 18 in the Mount Horeb and Barneveld areas. It also would impact an urban center in the city of Dodgeville along existing transmission lines and Highway 18, and border a residential concentration in the village of Cobb along an existing transmission line. See **Section 5** for additional detail on the proposed transmission line alignment in these areas.

The Alternate Route would border a residential concentration in the village of Rewey along a route that generally follows an existing transmission line. The Alternate Route diverts south of the existing transmission line and USH 151 to avoid a residential concentration in the city of Platteville. Depending on the segment chosen, the Alternate Route could also impact a residential concentration in the village of Cassville.

The proposed new Hill Valley Substation would be sited on the edge of the village of Montfort.

A list of impacted Project Area municipalities by county is included in **Section 1.4**.

1.6.6 Transmission Configuration

The Project involves the construction of a new 345 kV transmission line on predominantly single-pole structures. There are several existing 161 kV, 138 kV and 69 kV transmission lines along both the Preferred and Alternate Routes. Where the new 345 kV transmission line will follow an existing transmission corridor, the lower voltage line would be removed and rebuilt with the 345 kV line on double-circuit structures. There also are a number of distribution lines along the proposed alignments for both the Preferred and Alternate Routes that would be removed and relocated along the selected route. Additional details regarding the proposed transmission configurations are provided in **Section 5.3**.

1.6.7 Proposed Project Right-of-Way (ROW)

Both the Preferred and Alternate routes would share existing rights-of-way (ROW) by either partially overlapping or completely overlapping with the ROW of transmission lines, highways, railroads and pipelines. Some new ROW is proposed where appropriate to connect existing linear corridors. For the transmission line from the Mississippi River crossing to the Hill Valley Substation, the proposed Preferred Route shares existing infrastructure ROW for approximately 99 percent of its length. The Alternate Route from the Mississippi River crossing to the Hill Valley Substation shares existing infrastructure ROW for approximately 90 percent of its length.

For the transmission line from the Hill Valley Substation to the Cardinal Substation, the Preferred Route shares existing infrastructure ROW for approximately 93 percent of its length. If the Commission selected the Preferred Route, approximately 47 percent of the ROW acreage required for the Project would be shared with existing infrastructure ROW, reducing the amount of new ROW needed. The Alternate Route from the Hill Valley Substation to the Cardinal Substation would share existing infrastructure ROW for approximately 30 percent of its length. If the Commission selected the Alternate Route, approximately 18 percent of the ROW acreage required for the Project would be shared with existing infrastructure ROW.

1.7 Other Agency Correspondence, Permits and Approvals

1.7.1 Agency Correspondence

Copies of the Applicants' correspondence with governmental agencies concerning the Project are included in **Appendix H**. The governmental agencies with Project correspondence as of the date of this CPCN filing include the Dane County Parks Department, WDNR, Wisconsin Department of Transportation (WisDOT), Wisconsin Department of Agriculture Trade and Consumer Protection (DATCP), United States Army Corps of Engineers (ACOE), United States Fish and Wildlife Service (USFWS), Federal Aviation Administration (FAA), United States Department of Agriculture Rural Utilities Service (RUS), and the Federal Permitting Improvement Steering Committee (FPISC).

1.7.2 State and Federal Permits and Approvals

The state and federal permits and approvals required for the Project and the status of those approvals are listed below:

Federal Agencies			
Agency	**Activity**	**Permit Type**	**Status**
U.S. Department of Agriculture, Rural Utilities Service	Financial Assistance for Dairyland	NEPA compliance as lead agency, including National Historic Preservation Act Section 106 consultation and Endangered Species Act Section 7 consultation	Certification of Control and Responsibility submitted July 27, 2015 and is included in **Appendix H, Exhibit 1**.
ACOE	Wetland Impacts	Section 404 of the Clean Water Act	Will apply after a route is ordered
	Archaeological Review	Section 106 National Historic Preservation Act	Occurring as part of NEPA review
	Navigable Waterways	Section 10 of the Rivers and Harbors Act	Will apply after a route is ordered
	Real Estate Land Use	Easement for transmission ROW on ACOE-owned lands	Outgrant Application Submitted January 31, 2017 and is included in **Appendix H, Exhibit 2**.
FAA	Construction of Electric Transmission Lines Near Airports	FAA 7460 (Notification)	Preliminary notifications submitted and are included in **Appendix H, Exhibit 3**. Final notifications submitted after route is ordered and final design is complete.
USFWS	Impacts to federally	Section 7 Consultation	Draft Biological

Federal Agencies			
Agency	**Activity**	**Permit Type**	**Status**
	listed species	under Endangered Species Act	Assessment under federal agency review
USFWS	Right-of-Way on Upper Mississippi River National Wildlife and Fish Refuge (Refuge)	Special Use Permit for crossing the Refuge, Easement for crossing USFWS owned land	Will apply after a route is ordered by PSCW and determined to be compatible by USFWS on the Refuge

State Agencies			
Agency	**Activity**	**Permit Type**	**Status**
DATCP	Potential use of eminent domain on more than 5 acres of any farm	Agricultural Impact statement (AIS)	DATCP to contribute to state Environmental Impact Statement per Wis. Stat. § 32.035(2).
WisDOT	Overhead highway crossings and construction within those permitted areas.	Utility Permit DT 1553	Meetings with WisDOT were held and correspondence including a draft constructability report is in **Appendix H, Exhibit 4**. Applicants will apply for necessary permits after a route is ordered.
	Construction adjacent to, with-in, or co-location with the ROW of State Highways & Roads	Utility Permit DT 1553	
	Oversize Loads or Excessive Weights on Highways	Wis. Stat. ch. 348 Vehicles – Size, Weight and Load; Wis. Stat. § 348.25-Vehicle Weight and or Load Permit	

State Agencies			
Agency	**Activity**	**Permit Type**	**Status**
Wisconsin Historical Society	Impacts to previously documented cultural resources	Approval of Archaeological Review for state agency actions (Wis. Stat. § 44.40 and Section 106 of National Historic Preservation Act)	See **Section 6.7**
WDNR	See **Section 8.0**	See **Section 8.0**	See **Section 8.0**

1.7.3 Local Permits

The necessity of seeking local approvals for this utility construction Project is governed by Wis. Stat. §§ 196.491(3)(i) and 196.491(4)(c)3.

The Applicants will apply for those permits and other authorizations governed by local ordinances (county, town, village, or city) that involve matters of public safety. Because the ordinances of the local units of government vary, each construction project may involve different local permits and/or authorizations. The public safety-related permits or authorizations that the Applicants apply for generally include road crossing permits, road weight limits, noise abatement ordinances (usually involving hours or times of construction), and other similar public safety-related permits or authorizations that may be required by local ordinance.

Local ordinances also often address siting and location issues for the construction of utility facilities or land use issues including recreational uses and aesthetics. These types of authorizations would require conditional use permits, zoning permits or variances, which often involve quasi-judicial proceedings and the exercise of discretion on the part of the local unit of government as to whether the authorization or permit may be granted. Because the Commission's statutory obligation is to address the siting of proposed utility facilities, and to address land use, recreational use and aesthetics in the siting and route selection for transmission lines, the Applicants do not apply for these types of permits or authorizations. Wis. Stat. 196.491(3)(i). However, the Applicants will work with all local units of government to assure that the representatives of those units of government affected by the proposed Project are informed concerning proposed construction activities and request that the local unit of government provide the PSCW and the Applicants with its comments or concerns regarding the siting and location of the proposed Project.

Notwithstanding, per local zoning representatives, the following local permits and ordinances may apply[4] to the proposed Project absent the provisions of Wis. Stat. § 196.491(3)(i):

[4] Applicants accepted evaluations of local zoning representatives and did not seek to reconcile any differences between those evaluations and the local zoning ordinance or to modify the statements based on any applicable new state legislation.

Table 1.7.3-1 County Ordinances

County	Ordinances
Dane	Shoreland, Shoreland-Wetland, and Inland-Wetland Regulations; Floodplain Zoning; Erosion Control and Stormwater Management; Conditional Use
Grant	Floodplain Zoning, Shoreland Zoning; Conditional Use
Iowa	Shoreland Protection, Floodplain Zoning, Height Limitation Zoning: Structures and Trees in Vicinity of Iowa County Airport/Tri-County Regional Airport, Conditional Use
Lafayette	Floodplain Ordinance, Shoreland/Wetland, Zoning

Table 1.7.3-2 Municipal Ordinances

Municipality	Ordinances
In Dane County	
Village of Blue Mounds	Floodplain Regulations; Erosion, Sediment and Water Runoff Control; defers to Dane County for shoreland/wetland regulations
Town of Blue Mounds	Zoning, Conditional Use
Town of Cross Plains	Floodplain Zoning; Erosion Control and Stormwater Management ordinances
Town of Middleton	Stormwater Management and Erosion Control
Village of Mount Horeb	Erosion and Stormwater Control; Shoreland Zoning; Floodplain Zoning
Town of Springdale	Floodplain Zoning; Erosion Control and Stormwater Management ordinances
In Grant County	
City of Platteville	Floodplain Zoning, Construction and Post-construction erosion, sediment, stormwater management control, and Conditional Use
In Iowa County	
Town of Brigham	Erosion Control and Stormwater Management
City of Dodgeville	Stormwater Mgmt, Floodplain Zoning, and Conditional Use
Village of Cobb	Zoning, Conditional Use
Village of Rewey	Zoning

1.7.4 Railroad ROWs

Route segments on the proposed route alternatives cross or share railroad ROW along all or parts of their length as shown in the below tables.

Table 1.7.4-1 – Preferred Route Railroad ROW

Segment	Share ROW	Cross ROW
A02	None	Burlington Northern-Santa Fe
Y05	Wisconsin & Southern (WisDOT owned ROW)	None
Y06A	None	Wisconsin & Southern (WisDOT owned ROW)
Z01B	Wisconsin & Southern (WisDOT owned ROW)	None
Z02	None	Wisconsin & Southern (WisDOT owned ROW)

Table 1.7.4-2 – Alternate Route Railroad ROW

Segment	Share ROW	Cross ROW
Y05	Wisconsin & Southern (WisDOT owned ROW)	None
Y06A	None	Wisconsin & Southern (WisDOT owned ROW)
Y06B	None	Wisconsin & Southern (WisDOT owned ROW)

Table 1.7.4-3 – Other Route Segments Railroad ROW

Segment	Share ROW	Cross ROW
B02	None	Burlington Northern-Santa Fe
Z01A	Wisconsin & Southern (WisDOT owned ROW)	None

Table 1.7.4-4 – Route Segments that cross or share abandoned Railroad ROW[5]

Route	Segment	Share ROW	Cross ROW
Preferred Route	Q02	None	Union Pacific
Alternate Route	H07	None	Union Pacific
Alternate Route	P01	None	Union Pacific
Other Route Segments	J01	None	Union Pacific
Other Route Segments	R03	None	Union Pacific
Other Route Segments	Q02	None	Union Pacific

[5] ROW does not currently host railroad facilities and is presumed to be abandoned. Land ownership is retained by Chicago and North Western Transportation Company, which is now Union Pacific.

In the Applicants' communications with the railroad companies, and consistent with the Applicants' previous project experiences, the railroad companies prefer to wait and review final alignments once a transmission line route is ordered. After the Commission's selection of a route, the Applicants will follow standard permit application procedures for utility crossings and installations of railroad ROW. Where the transmission line parallels a railroad, the Applicants will work with the railroad companies to determine if installation of the new line would create objectionable induction in their facilities and provide mitigation if necessary. Where the transmission line crosses a railroad, the Applicants will comply with National Electrical Safety Code Sections 231 and 232, as adopted in Wis. Admin. Code ch. PSC 114, or the railroad company's reasonable clearance requirements, whichever is more stringent.

1.7.5 Pipeline ROWs

Route segments on the proposed route alternatives cross or share pipeline ROW along all or parts of their length as shown in the tables below.

Table 1.7.5-1 – Preferred Route Pipeline ROW

Segment	Share ROW	Cross ROW
D08	None	Northern Natural Gas
Q03	None	Northern Natural Gas

Table 1.7.5-2 – Alternate Route Pipeline ROW

Segment	Share ROW	Cross ROW
F03	None	Northern Natural Gas
P06	None	Northern Natural Gas

Table 1.7.5-3 – Other Route Segments Pipeline ROW

Segment	Share ROW	Cross ROW
F04	None	Northern Natural Gas
F09	None	Northern Natural Gas
F10	Northern Natural Gas	None
F12	Northern Natural Gas	None
G02	None	Northern Natural Gas
R09	None	Northern Natural Gas

After the Commission selects a route, the Applicants will work with the pipeline company to ensure that the approved route alignment will not adversely impact pipeline operation. Where the transmission line parallels a pipeline, the Applicants will work with the pipeline company to determine if installation of the new line would create objectionable induction in their facilities and provide mitigation if necessary. Where the transmission line crosses a pipeline, the Applicants will work with the pipeline company on clearances from the pipeline to the Applicants' structures or foundations.

1.7.6 Wisconsin DOT

Proposed route segments that share ROW or cross State (STH) and/or United States Highway (USH) along all or part of the segment are provided in Tables 1.7.6-1, 1.7.6-2 and 1.7.6-3 below:

Table 1.7.6-1 – Preferred Route Highway Corridor Sharing and Crossings

Segments	Highway	ROW Length Shared (miles)
A03	STH 133	Crossing
D04	USH 61, STH 81	Crossing
D05	STH 129	Crossing
Q01, Q02, Q03, Q04, Q05	USH 18	13.2
N01	STH 80	Crossing
N04, N05, N06	USH 18	0.3
S01, S04, S05, S08, S09, S10A, S10B, S10C, S10D, S13	USH 18/151	19.9
T01	USH 18/151	Crossing
Y05	USH 14	0.5
Y06A	USH 14	Crossing
Z01B	USH 14	0.8
Z02	USH 14	Crossing

Table 1.7.6-2 – Alternate Route Highway Corridor Sharing and Crossings

Segments	Highway	ROW Length Shared (miles)
C02	STH 133	Crossing
C04	STH 81	Crossing
E01	STH 133	Crossing
E04	STH 133	Crossing
E14	STH 61	Crossing
G06	USH 151	0.6
G06	STH 80	Crossing
G09	USH 151	Crossing
K01	STH 80	2.0
L01	STH 80	0.2
N01	STH 80	Crossing
N04, N05, N06	USH 18	0.3
Y05	USH 14	0.5
P01	USH 18	Crossing
P02	STH 80	Crossing
P06	STH 23	0.4
P09	STH 78	Crossing
Y06A	USH 14	Crossing
Y06B	USH 14	Crossing

Table 1.7.6-3 – Other Route Segments Highway Corridor Sharing and Crossings

Segments	Highway	ROW Length Shared (miles)
B02	STH 133	Crossing
C01	STH 81	Crossing
D06	STH 129	Crossing
D07	STH 129	Crossing
E15	USH 61	Crossing
F11	STH 80	Crossing
F13	USH 151	4.4
G02, G03, G04, G05	USH 151	2.9
G07	USH 151	Crossing
J01	STH 80	0.3
J04	STH 80	Crossing
R01	STH 80	Crossing
R06	STH 39	Crossing
R09	STH 23	Crossing
R10, R11, R13, R14, R15	USH 18/151	3.5
S02	USH 18/151	Crossing
S03	USH 18/151	2.98
S11A, S11B, S11C, S11D	USH 18/151	0.4
U01	USH 18/151	1.0
Z01A	USH 14	0.8

The construction of a transmission line along highway corridors in Wisconsin requires close coordination with WisDOT. The Applicants and their consultants met with WisDOT representatives on multiple occasions to discuss the Project. A general overview of the Project was provided to WisDOT staff at these meetings and there was detailed discussion about the constructability of the transmission line along the highways.

WisDOT provided input at these meetings during the routing and siting process, including any plans for future highway expansion so that alternative alignments in these locations could be developed and discussed to ensure specific alignments could be permitted. Documentation from these meetings is provided in **Appendix H, Exhibit 4**.

1.8 Construction Schedule

1.8.1 Construction Schedule

The Applicants anticipate constructing the Project according to the following schedule:

Project Activity	Preliminary Date
Submittal of PSCW CPCN Application and WDNR Utility Permit	April 2018
Start Substation Construction	October 2020
Start Transmission Line Construction	October 2021
Project In-Service	December 2023

Based on preliminary consultation with federal agencies, the Applicants are assuming that a seasonal restriction on tree clearing will be required between June 1-July 31. It is possible that other seasonal restrictions will apply in specific locations to avoid or minimize impacts to listed species or other environmental resources. In addition, some specific construction activities are dependent on obtaining required line outages on transmission and distribution lines that are owned by multiple entities or may only be accomplished during specific generating unit outages as discussed in Section 1.8.2. Therefore, these schedules are dependent on the availability of outages.

1.8.2 Outage Constraints

The Project team will coordinate with ATC system operations and Dairyland system operations[6] to establish outage sequencing and to coordinate the transmission outages necessary to construct the Project. Determining appropriate construction outage sequencing and windows requires the evaluation of many factors, including area loads and the availability of area transmission and generation facilities. Construction outages will require direct coordination with operators of generation located in Rock, Dane, and Columbia counties. Construction outages will also require direct coordination with transmission outages in northeast Iowa, northern Illinois and in southwestern Wisconsin from the Mississippi River east to Rock, Dane, and Columbia counties.

The 138 kV and 69 kV transmission lines in the Project Area are the backbone of the transmission system in southwest Wisconsin, which make them particularly difficult to take out of service while maintaining the reliability of the system. As identified in Section 5.3.4, Applicants propose to co-locate the new 345 kV transmission line with existing 138 kV and 69 kV lines along both the Preferred and Alternate routes. Constructing the new 345 kV line double-circuit with an existing line on or near the existing centerline requires the existing line to be taken out-of-service. Based on the nature of the construction activities, lengthy outages with

[6] ITC Midwest does not currently own transmission facilities in Wisconsin.

no requirement for a quick return to service would be necessary of these critical lower voltage circuits. Due to their criticality, these circuits are subject to short recall times, potentially as short as 12 to 24 hours depending on system conditions. As a result, the Applicants propose to construct the Project offset from the existing transmission lines as identified in Section 5.3. This will allow these existing lines to remain in-service during construction. Once the new double-circuit lines are placed in service, the existing lines will be removed.

There may be additional outage constraints that may preclude construction during certain times of the year, however, with the projected start of construction being approximately three years away, it is difficult to predict or foresee these particular outage constraints at this time.

1.9 Project Maps

Consistent with the Application Filing Requirements, a set of Project maps is provided in **Appendix A.** The maps show the Preferred and Alternate Routes and Other Route Segments under review by federal agencies. Project data is provided on aerial photographs and includes environmental, parcel, land use, and existing utility/infrastructure data. Also included is environmental information required to support the WDNR permitting activities. The Applicants are providing separately to the Commission, in electronic format on discs, Geographic Information System (GIS) data files supporting the mapping.

1.10 ESRI ArcGIS Data Files

All Project maps were created using ESRI ArcGIS Version X. A spreadsheet of each GIS file, including the description of the data, the data source, and the date of when the data was generated or collected is provided to the Commission as part of the GIS data disc.

1.11 Mailing Lists

The mailing lists are provided in Microsoft Excel format separately to the Commission on compact disc. The information used to compile the mailing lists was derived from county tax parcel data obtained from Dane, Grant, Iowa, and Lafayette counties in Spring 2017. Data regarding local officials was obtained from the applicable counties and municipalities. The Applicants expect that this information is reasonably accurate but recognize that changes in personnel occur over time.

2.0 PROJECT NEED AND ENGINEERING

In December 2010 and October 2011, the Federal Energy Regulatory Commission (FERC) approved MISO's MVP Tariff, which defines the standards for designating a transmission facility as an MVP. Generally, to be designated as an MVP, a project must provide substantial regional economic, reliability and public policy benefits. The MVP Tariff also provides for cost-sharing of projects that meet those standards after a comprehensive planning analysis. MISO staff subsequently analyzed and recommended a set of MVPs, including the Project proposed in this Application, for inclusion in Appendix A of the MISO Transmission Expansion Plan (MTEP) 2011 analysis. These MVPs were approved by the MISO Board of Directors (BOD) on December 8, 2011, with the BOD directing "transmission owners to use due diligence to construct the facilities approved in the plan."

As summarized below and discussed in detail in Appendix D, as part of this Application the Applicants evaluated the Project from a more Wisconsin-specific perspective. And based on their own joint planning analyses, the Applicants have concluded that the Project provides substantial net economic, reliability, and public policy benefits to Wisconsin customers. In conducting this analysis, the Applicants compared the Project to a low-voltage transmission alternative, a no-action alternative, and a non-transmission alternative, and determined that the Project provides the highest total net benefits from an economic, reliability, and public policy perspective.

2.1 Project Need

The Project fulfills a well-recognized and longstanding need to tie-in the 345 kV electric transmission systems in southwest and southcentral Wisconsin and Iowa. Currently, Wisconsin and Iowa are electrically connected via a 161 kV line and two 69 kV lines, which MISO and the Applicants, after their independent evaluations, deemed wholly inadequate to serve future needs.

As described in more detail below, the Project if constructed will:

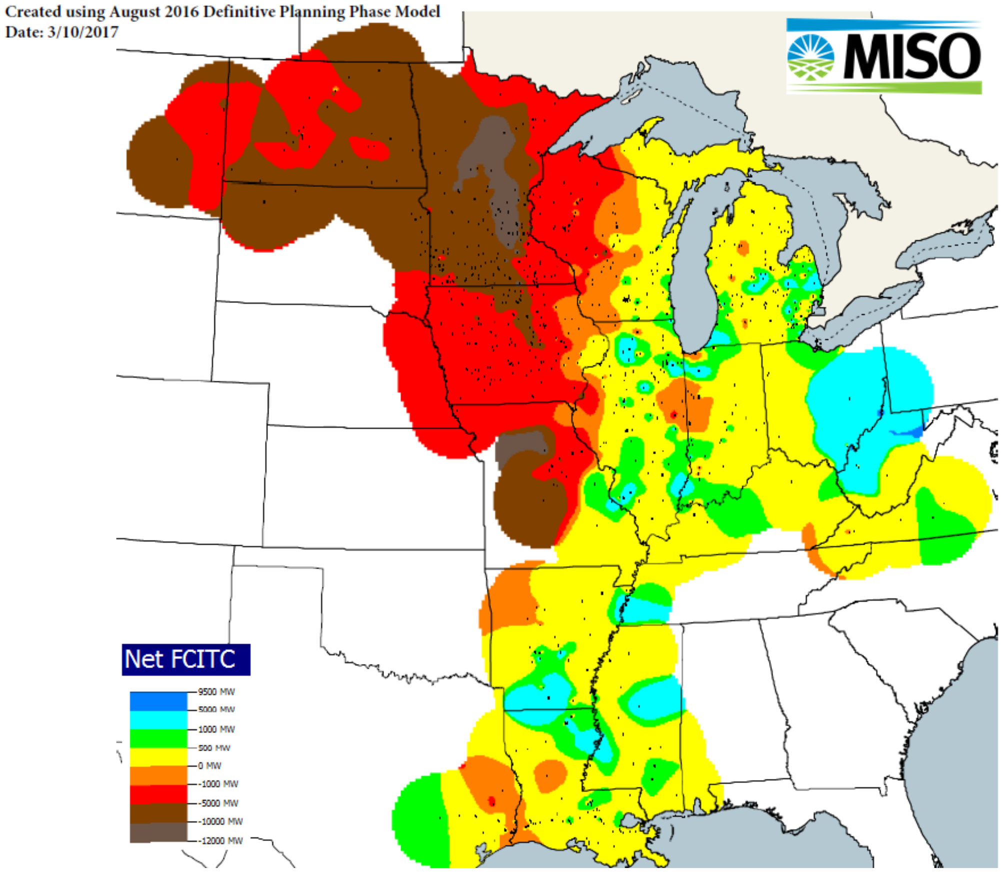
- Provide net economic benefits to Wisconsin customers (even after accounting for the Project's cost to Wisconsin customers) of between $23.5 million and $350.1 million over its 40-year expected life;
- Avoid the need to spend between $87.2 million and $98.8 million on reliability projects and asset renewal projects over the 40-year life of the Project that would otherwise be needed if the Project were not constructed;
- Increase the transfer capability of the electric system between Iowa and southwest and southcentral Wisconsin by approximately 1,300 MW, thereby easing congestion, increasing generator competition, and allowing the transfer of additional low-cost wind energy into the state;
- Allow low-cost wind energy that is trapped in areas to the west of Wisconsin to be released to the system by allowing more than a dozen new low-cost wind facilities to fully interconnect to the electric system and deliver their full output;

- Support 25 GW of low-cost wind resources that have requested interconnection in Iowa and areas west of Wisconsin, including some wind farms owned by Wisconsin utilities and wind farms with which these utilities have power purchase agreements;
- Eliminate the need for three MISO system operating guides in southwest and southcentral Wisconsin, which currently require load shedding and/or other operational actions under certain contingencies due to reliability concerns in the area; and
- Create numerous other reliability and public policy benefits stemming from a more robust and flexible electric transmission system in the state.

The upper Midwest has some of the best low-cost wind generation resources in the country. In fact, a substantial amount of low-cost wind generation is currently being developed in Iowa, Minnesota, and North and South Dakota. However, transmission congestion and reliability constraints have limited—and (unless the Project is constructed) will continue to limit—the flow of low-cost wind energy from these areas into Wisconsin.

By way of example, consider the following map showing the first contingency incremental transfer capability (FCITC) of the areas around Wisconsin:

Figure 2.1-1: MISO Net FCITC in the August 2016 DPP Model[7]



The areas in red and brown are high wind development areas where thousands of megawatts of low-cost wind capacity have been built or are currently being built. These areas have significant *negative* net transfer capability because they have a large number of generation interconnection requests but also have an insufficient transmission network to get the power from these areas to the load centers in Wisconsin and to other areas farther east. In other words, low-cost wind energy is trapped in areas further to the west. The Project would help to address this issue by connecting the high-voltage transmission systems in southwest and southcentral Wisconsin to Iowa.

The Applicants' analysis compared the Project against three alternatives: the No-Action alternative, a Low-Voltage alternative, and a Non-Transmission alternative including energy efficiency, demand response and distributed generation. For each of these alternatives, the Applicants analyzed the following potential economic benefits:

[7] MISO, GI Contour Map (Mar. 10, 2017), https://cdn.misoenergy.org/GI-Contour_Map108143.pdf [last accessed on 4/2/2018].

- Energy Cost Savings: The Energy Cost Savings represent each alternative's ability to lower overall energy costs for Wisconsin customers. Table 2.1-4.
- Capacity Loss Savings: These are the savings resulting from the reduction in capacity costs that occur for each alternative. Table 2.1-5.
- Insurance Value: The Insurance Value is the reduction in the economic impact of severe generation or transmission outages if each alternative is constructed. Table 2.1-6.
- Avoided Reliability Project Benefits: These are the benefits from avoiding the need to construct future reliability projects if each alternative is constructed. Table 2.1-8.
- Asset Renewal Benefits: These are the benefits associated with avoiding the need to renew and replace existing transmission lines if each alternative is constructed. Table 2.1-9.

To determine the net benefits of the various alternatives, the Applicants used the following formula:

$$Net\ Benefit\ (Cost) = \left(\begin{array}{c} \boldsymbol{GREATER\ OF}: \\ Energy\ Cost\ Savings + \\ Insurance\ Value \\ \boldsymbol{OR} \\ Avoided\ Reliability\ Benefits + \\ Asset\ Renewal\ Benefits \end{array} \right) + \begin{array}{c} Capacity\ Loss \\ Savings \end{array} - \begin{array}{c} Costs\ to \\ WI\ Customers \end{array}$$

Rather than simply adding all of the benefits together, the Applicants used the higher of the sum of the Energy Cost Savings and Insurance Value benefits or the sum of the Avoided Reliability and Asset Renewal Benefits to ensure no double counting of benefits.

As discussed in more detail below, the Applicants calculated the net benefits and costs of each alternative using five different future scenarios, called "futures." Each future includes specific assumptions about the key factors or drivers of the electric industry in the 2021, 2026, and 2031 study years. These futures, when taken together, present a range of plausible scenarios that are bounded by extreme but still plausible hypothetical future events. During the 40-year life of this Project, actual events are more likely to move through and even between the various futures, rather than remain statically within a single future.

The Project performed much better than all of the other alternatives evaluated in the Applicants' analysis. In fact, in all futures, the economic benefits of the Project exceeded the Project's estimated $66.2 million cost to Wisconsin customers. In other words, the Project is expected to provide customers with net economic benefits (rather than net costs) over its 40-year life in all futures.

Table 2.1-1 below summarizes the results of these calculations.

Table 2.1-1: Monetized Range of Net Benefits of Alternatives to Wisconsin

Estimated Costs of Alternatives[1]				
Project Cost to Wisconsin ($M – 2018 PV)				**66.2**
LVA Cost to Wisconsin ($M – 2018 PV)				**220.6**
NTA Cost to Wisconsin ($M – 2018 PV)				**70.3**
Net Benefits of Evaluated Alternatives (Including Costs; $M – 2018 PV)				
Future	**No Action**	**Project[2]**	**LVA**	**NTA**
Existing Fleet (EF)[3]	0.0	23.5	(132.4)	(9.7)
Policy Regulations with Low Energy (PRLE)	0.0	156.9	(18.6)	(0.6)
Policy Regulations (PR)	0.0	106.3	(47.7)	(10.3)
Policy Regulations with Foxconn (PRFoxconn)	0.0	130.0	(15.3)	(24.2)
Accelerated Alternative Technologies (AAT)	0.0	350.1	270.4	25.4

1. This is calculated as the present value of revenue requirements charged to Wisconsin.
2. The estimated cost and net benefits of the Preferred Route are shown. The cost of CHC to Wisconsin with the Alternate Route is $71.8M (2018 PV), which is approximately $5M more than the Preferred Route. However, this increase in cost does not substantially affect the outcome of the analysis.
3. For the LVA and CHC alternatives, the benefits include the sum of the Avoided Reliability and Asset Renewal Benefits of the Preferred Route instead of the sum of the Energy Cost Savings and Insurance Value in the EF future.

As shown in Table 2.1-1, the Project outperforms the studied alternatives in every future and provides the greatest total net benefits for Wisconsin customers relative to these alternatives. This demonstrates that the Project is the most cost-effective means of facilitating the delivery of low-cost energy and capacity to Wisconsin customers and improving the reliability of the high-voltage transmission system.

These results also demonstrate that the Project's need is not tied directly to energy and load growth. As shown in Table 2.1-1, the Project has more net benefits in the PRLE future than it does in the PR future. Yet the PRLE future is identical to the PR future, except for the PRLE future uses lower MISO demand and energy assumptions. In other words, when the Applicants lowered the energy and demand assumptions in the models, the net benefits of the Project increased.

In sum, from a purely economic benefits perspective, the Project is superior to all of the other alternatives evaluated. Of course, this analysis does not account for the Project's qualitative reliability and public policy benefits, which were not quantified in the Applicants' Planning Analysis but which are also described in further detail below.

2.1.1 Previous Studies of the Benefits of the Project

A high-voltage transmission link between the Madison, Wisconsin, area and Iowa has been discussed and studied for almost a decade. In 2008, the governors of Iowa, Minnesota, North Dakota, South Dakota, and Wisconsin formed the Upper Midwest Transmission Development Initiative (UMTDI) to "identify and resolve regional transmission planning and cost allocation issues" within the five-state area.[8] The UMTDI effort evaluated the need for an estimated 15,000 MW of wind energy and identified wind zones where wind resources would most likely develop. The 2010 UMTDI Report identified the electrical equivalent of the Project as one of five "no regrets" or "first mover" projects that would meet transmission needs under a variety of future circumstances. The "first mover" projects included the La Crosse to Madison connection which later became the Badger Coulee project. The Badger Coulee project received approval from the PSCW in 2015 and is currently being constructed. UMTDI also identified a line connecting Dubuque, Iowa, to Spring Green, Wisconsin, and on to Madison, Wisconsin as a first mover project. This Project includes these key endpoints, with a slightly modified mid-point in Montfort, Wisconsin.

MISO's[9] 2008 Regional Generation Outlet Study (RGOS) arrived at a similar conclusion. The RGOS was a collaborative, multi-year effort involving state utility regulators and industry stakeholders. It was intended to identify transmission facilities that would meet renewable energy requirements within MISO in the most cost-effective manner. The RGOS identified 18 candidate projects that would "provide for the continuation and extension of the west to east transmission path to provide more areas with greater access to the high wind areas within the Buffalo Ridge and beyond."[10] Those candidate projects included a 345 kV line between La Crosse and Madison (the Badger Coulee Project, PSCW Docket No. 05-CE-142) and a 345 kV line between Dubuque and Madison (the Project).

MISO subsequently conducted eleven months of intensive study on the RGOS portfolio of projects to develop a portfolio of MVPs, and ultimately included the Project in this portfolio. MISO found that, as a whole, the MVP portfolio would reduce congestion, improve competition in wholesale markets, spread the benefits of low-cost generation across the MISO footprint, and facilitate the reliable delivery of renewable energy in accordance with state renewable portfolio standards (RPSs). MISO found that the portfolio of projects would improve power transfer capability between Iowa and Wisconsin, relieve reliability constraints on the

[8] UMTDI Executive Committee Final Report, September 29, 2010 (UMTDI 2010 Report), p. 1
[9] At the time, MISO was known as the Midwest Independent Transmission System Operator, Inc.
[10] MISO 2010 RGOS Report, p. 95

surrounding transmission system, and facilitate the delivery of additional low-cost wind energy into Wisconsin.[11]

The Applicants were active participants in the MISO open-stakeholder planning processes from 2008 to 2011 that resulted in the development of the MVP portfolio. As part of this coordination with MISO, ATC evaluated the Project's economic, reliability, and qualitative effects pursuant to the ATC planning provisions of the MISO Tariff (Attachment FF-ATCLLC). Applicants also actively participated in the MISO cost-allocation process for the MVPs (called the Regional Expansion Criteria and Benefits Task Force) and in the FERC tariff proceeding on this subject. Additional information regarding MISO's MVP process, as it relates to the Project, is provided below in Section 2.10 of this Application.

MISO's most recent triennial review of the MVP portfolio indicates that the MVP portfolio, including the Project, will substantially benefit Wisconsin customers. MISO reaffirmed its finding that the MVP portfolio would enhance generation flexibility, create a more robust and reliable regional transmission system, increase the geographic diversity of wind resources that can be delivered, support the creation of thousands of local jobs and billions in local investment, and reduce emissions of carbon dioxide by 9 to 15 million tons annually.[12] MISO also found that the MVP portfolio would (1) provide benefits that are 2.2 to 3.4 times its cost; (2) generate $12.1 to $52.6 billion in net benefits over the next 20 to 40 years; and (3) enable the delivery of 52.8 million megawatt-hours of wind energy to meet renewable energy mandates and goals through 2031.[13]

2.1.2 Benefits of the Project

ATC's planning department took the lead in conducting the Planning Analysis for the Project, but consulted with ITC and DPC throughout the process. The planning departments of ATC, Dairyland, and ITC Midwest have a long history of analyzing the economic, reliability, and other quantitative and qualitative benefits and costs of utility infrastructure, including high-voltage transmission line projects. As described below, the Project will provide a key transmission connection between Wisconsin and Iowa allowing the transfer of low-cost wind energy between the two states and adding a high voltage transmission line to an area with limited high voltage facilities.

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[11] *MISO Multi Value Project Portfolio – Results and Analysis*, (01/10/12), Section 5.6 Dubuque to Spring Green to Cardinal 345 kV Line, p. 31-32; MISO, MTEP14 MVP Triennial Review, September 2014, p. 9.

[12] MISO, MTEP14 MVP Triennial Review, September 2014, p. 9.

[13] https://www.misoenergy.org/Library/Repository/Study/Candidate%20MVP%20Analysis/MTEP17%20MVP%20Triennial%20Review%20Report.pdf, p. 4.

2.1.2.1 Economic Benefits Analysis

The Project will generate substantial economic benefits for Wisconsin customers, which is largely because it will enable Wisconsin to import low-cost wind energy from areas west of the state. In addition, Wisconsin customers will bear only a portion, approximately 10 to 15% (approximately $66.2 million ($2018) of the Project's total estimated cost (approximately $492 million ($2018)) because, as an MVP, its overall cost will be spread across the MISO footprint. In other words, the Project provides substantial value to Wisconsin customers, who stand to reap significant economic benefits at only 10 to 15% of its total cost.

As part of the Planning Analysis, the Applicants modeled and calculated various potential economic benefits associated with the Project and its alternatives across five different futures. These economic benefits fall within five categories: Energy Cost Savings, Capacity Loss Savings, Insurance Value, Avoided Reliability Benefits, and Asset Renewal Benefits. This section provides additional details regarding the alternatives the Applicants studied, the futures in which those alternatives were studied, and the Applicants' calculation of each category of economic benefits for each alternative.

Studied Alternatives

The Applicants compared the economic benefits of the Project against three different alternatives: a no-action alterative, a low-voltage alternative, and a non-transmission alternative. A more detailed description of the Project and these alternatives is provided below:

- <u>No-Action Alternative (No-Action or NA)</u>: Under this alternative, no additional low- or high-voltage transmission lines are added to the system. This is the base case in the Planning Analysis against which the other electric alternatives are compared to determine their benefits and costs.
- <u>Cardinal-Hickory Creek Transmission Project (CHC or Project)</u>: The Project would extend a 345 kV transmission line from the existing Hickory Creek Substation in New Vienna, Iowa (northeastern Iowa) to a new substation located near Montfort, Wisconsin, to the existing Cardinal Substation in the Town of Middleton, Wisconsin. The estimated line distance from the Hickory Creek Substation to the Cardinal Substation is approximately 102 miles to 126 miles depending on the route chosen. The existing Hickory Creek 345/161 kV Substation is connected to the Hazleton-Salem 345 kV line. A new 345/138 kV substation would need to be constructed near Montfort, Wisconsin (the Hill Valley Substation). The Cardinal 345/138 kV Substation presently exists in the Town of Middleton, Wisconsin.

  The Project has a total cost estimate of $492 million in year-of-occurrence dollars and the present value (discounted to 2018) of the change in the net transmission charges to Wisconsin network customers is $66.2 million. Section 4.0 of this Application contains additional information regarding the cost of the Project.
- <u>Low-Voltage Alternative (LVA)</u>: The low-voltage alternative would include: (i) a 138 kV line from Cassville to Montfort, Wisconsin; (ii) an expanded or new 138 kV substation in

Montfort; (iii) a new 138 kV line from Montfort to Middleton, Wisconsin; (iv) an expanded or new 138 kV substation in Montfort; and (v) a new 345 kV line from New Vienna, Iowa to Cassville, Wisconsin and accompanying facilities. The LVA is assumed to follow the same general route as the Project. The Nelson Dewey Substation in Cassville does not have any transmission facilities above 161 kV, so to receive a new 345 kV line from Iowa, ATC would either have to expand this substation or construct a new 345/138 kV substation. The Eden Substation near Montfort would have to be expanded to add two breaker positions for the LVA, or an adjacent 138 kV substation would have to be constructed.

The LVA has a total project cost estimate of $356 million in year-of-occurrence dollars and the present value (discounted to 2018) of the change in the net transmission charges to the Wisconsin network customers would be an increase of $220.6 million. Importantly, the LVA is not an MVP and, based on discussions with MISO, the cost of the LVA would be recovered entirely from Wisconsin and Iowa customers. Additional information regarding the LVA is provided in Section 2.2 below and in Section 5.2 of the Planning Analysis provided as **Appendix D**.

- <u>Non-Transmission Alternative (NTA)</u>: The NTA is a mix of local energy efficiency, demand response, residential solar facilities, and a utility-scale solar plant connected to the Nelson Dewey 138 kV Substation. By definition, this alternative does not involve the construction of any additional transmission facilities, and would therefore do little to reduce transmission congestion or improve power transfer capability between Iowa and Wisconsin. However, to devise an NTA that is somewhat comparable to the Project, the Applicants assumed that the costs of the NTA would be approximately identical to the Project's lifetime costs to Wisconsin customers, or approximately $70.3 million in 2018 dollars.

  The Applicants then split the components of this alternative into energy efficiency, demand response in the form of interruptible load, and local renewable energy. The Applicants also input an amount of increased energy efficiency, in the form of more efficient lighting, that could be practically implemented in southwest and southcentral Wisconsin; this aspect of the NTA reduced summer peak by 2.6 MW. The Applicants also selected an amount of demand response that could be practically implemented at industrial facilities primarily in southwest and southcentral Wisconsin. The demand response portion of the NTA would provide 31 MW of interruptible load on summer peak. Finally, the Applicants assumed that the remaining funds could be used to cover the capital costs and lifetime O&M costs of a 30 MW utility-scale solar plant and 2 MW of residential solar facilities (both assumed to utilize photovoltaic solar cells). Table 2.1-2, below, shows the components of the NTA.

Table 2.1-2: NTA Components

Component	On Peak Capacity (MW)
Energy Efficiency	2.6
Demand Response	31.5
Utility-Scale Solar	30.0
Residential Solar Facilities	2.0
Total	66.1

Additional details regarding the NTA and other rejected NTAs can be found in Section 2.4, below, and in Section 5.3 in the Planning Analysis provided as **Appendix D**.

Other Alternatives Considered

As part of the Planning Analysis, the Applicants also evaluated and rejected various other potential alternatives, including several 345 kV alternatives, low-voltage alternatives, and non-transmission alternatives (including generation and non-generation alternatives). The other alternatives considered are described in more detail herein in Sections 2.2 through 2.5 and in Section 5.4 of the Planning Analysis provided as **Appendix D**.

Futures

The Applicants analyzed the net benefits of each of the aforementioned alternatives in five different futures, which were based on MISO's 2017 Transmission Expansion Plan (MTEP17). The MISO process for developing futures produces multiple long-term views of theoretical resource availability (both supply and demand) given different policy and economic drivers to ensure adequate "bookends." MISO develops its futures through a rigorous vetting process involving input from stakeholders representing each of the sectors in MISO.[14] The process for MTEP17 futures development spanned nine months and involved several opportunities for stakeholder feedback and comment, which MISO then incorporated into the final version of the futures.

MISO and its stakeholders identified key variables affecting the future delivered price of electricity, including load and energy forecasts, fuel prices, different levels and types of generation retirements and expansions, and the design and makeup of the regional transmission system. A plausible range of values was assigned to each of these drivers. Selected values for each of these drivers were then assigned to the following three MISO futures: Existing Fleet (EF); Policy Regulations (PR); and Accelerated Alternative Technologies (AAT).

[14] These sectors include transmission owners; independent power producers and exempt wholesale generators; power marketers and brokers; municipal, cooperative and transmission dependent utilities; public consumer advocates; state regulatory authorities; environmental/other stakeholder organizations; eligible end-use customers; and coordinating members.

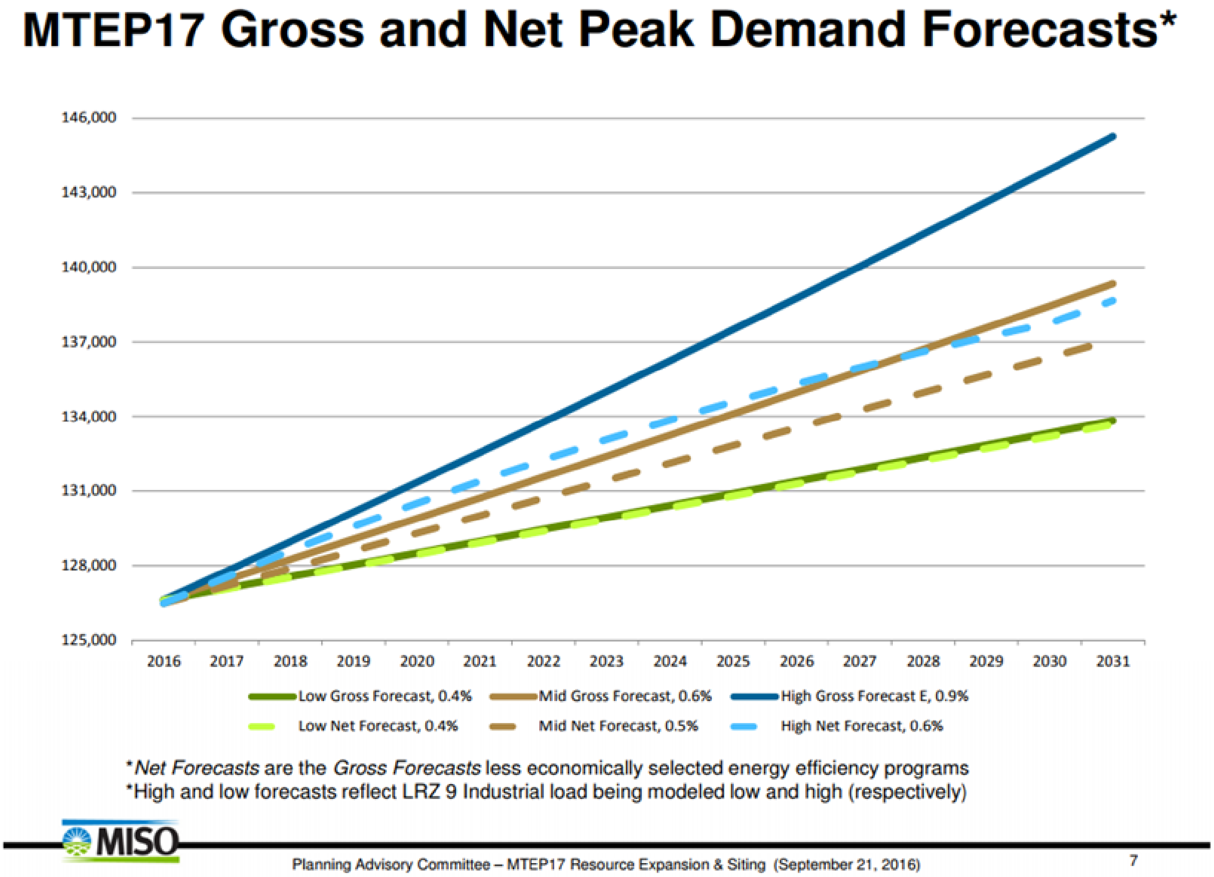
MISO does not identify which of its futures it considers to be a "base case." However, MISO does set base case assumptions for natural gas prices and demand/energy assumptions. The EF future assumes low demand/energy (10/90) and base minus 30% for natural gas prices; the PR future assumes base demand/energy (50/50) and base natural gas prices; and the AAT future assumes high demand/energy (90/10) and base plus 30% for natural gas prices. Moreover, when MISO asked its stakeholders to identify which of the three futures was most probable to occur, a plurality voted for the PR future.

The Applicants modeled the Project and its alternatives under all three MISO futures developed in the stakeholder process and two additional futures, both of which are variations on MISO's PR future: a PR future with low demand/energy in MISO (PRLE) and a PR future with the development of the Foxconn facility in Mount Pleasant, Wisconsin (PRFoxconn). The purpose of using these five futures is to create a bounded range of plausible futures under which the Applicants can evaluate each alternative's benefits. During the 40-year life of each alternative, actual events will likely fall somewhere between the defined futures most of the time and only occasionally fall completely within a particular future. If an alternative performs well in most or all of these futures, it is likely to be a robust project that will produce net benefits for customers.

As shown in Figure 2.1-2 below, all of the futures assume what would generally be considered historically low net demand and energy growth rates ranging from 20-year growth rates of 0.4% (Low) to 0.6% (High).[15]

[15] *See* MISO PLANNING ADVISORY COMMITTE, MTEP17 RESOURCE EXPANSION AND SITING RESULTS 7 (Sept. 21, 2016), https://old.misoenergy.org/Library/Repository/Meeting%20Material/Stakeholder/PAC/2016/20160921/20160921%20PAC%20Item%2002c%20MTEP17%20Futures%20Resource%20Forecast%20Results.pdf.

Figure 2.1-2: Gross and Net Demand Forecasts in MISO MTEP17 Futures



Similarly, for natural gas price assumptions, MISO used the verbatim NYMEX forecast for the first two years (2016-2017), and an average of the Wood Mackenzie No Carbon and EIA forecasts, as shown in Figures 2.1-3 and 2.1-4 below:

Figure 2.1-3: MISO MTEP17 Base Gas Forecast[16]

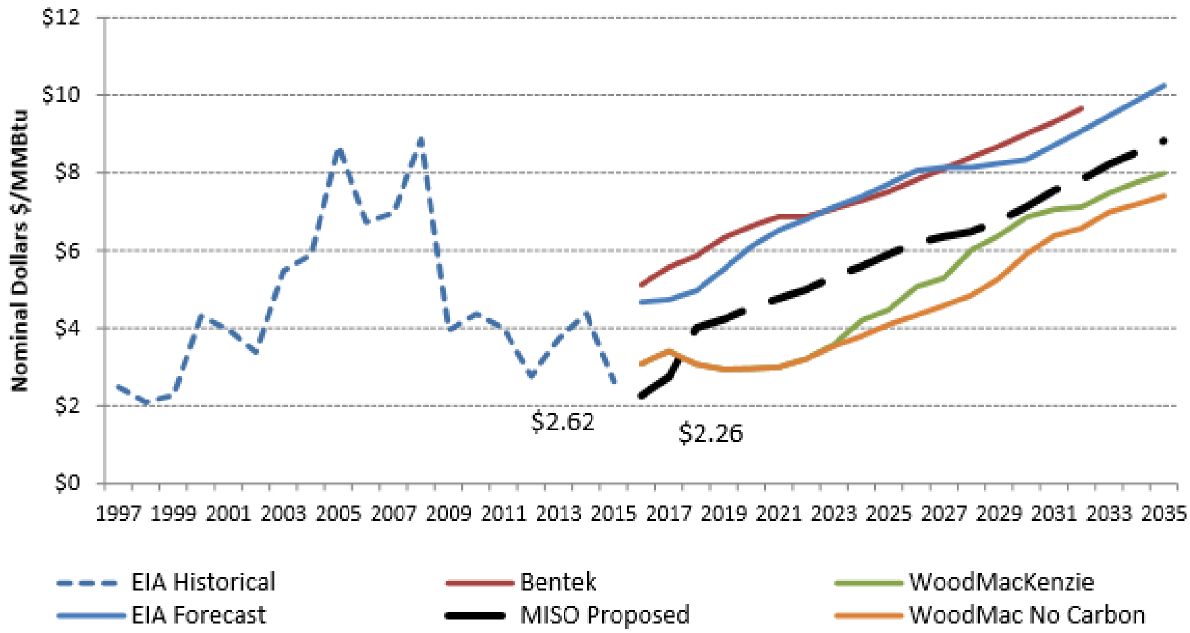
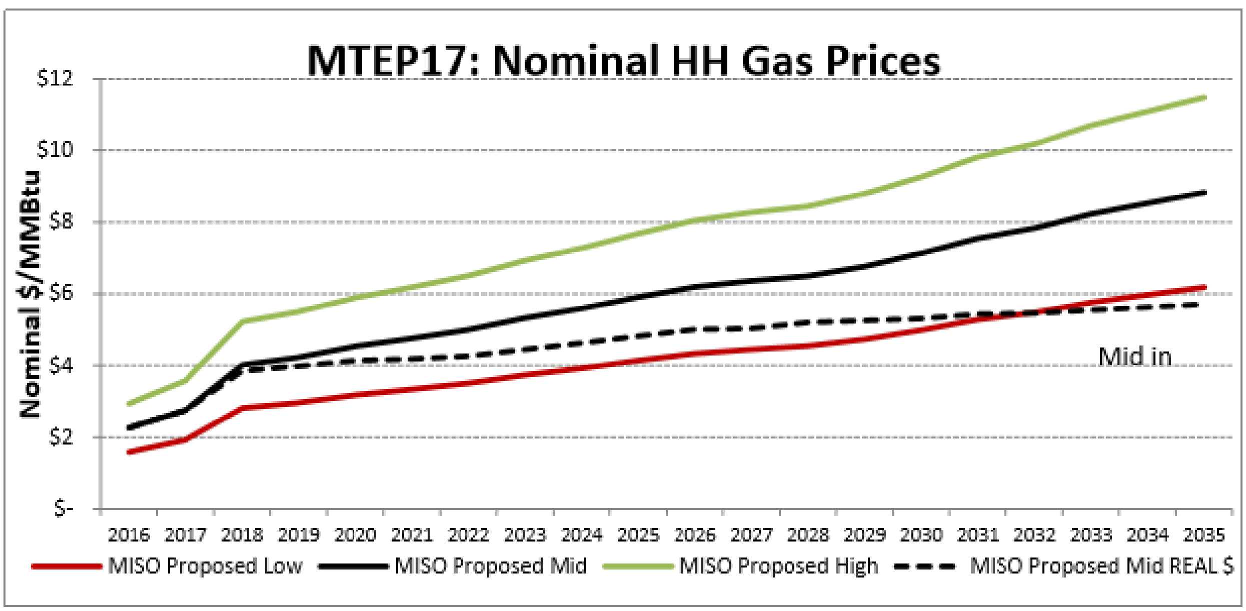


Figure 2.1-4: Additional Background on MISO MTEP17 Gas Price Forecast[17]



When MISO and its stakeholders first began working on the MTEP17 futures, the Clean Power Plan was still in place. However, prior to the futures being finalized (and before the

[16] *Id.* at 27.
[17] *Id.* at 27.

stakeholders voted on them), the U.S. Supreme Court stayed the Clean Power Plan. Because of the stay, none of the MISO futures expressly assumed the Clean Power Plan would be in place. However, as shown in Table 2.1-3, both the PR future and the AAT future still included some assumptions about region-wide carbon emission reductions.

The current energy marketplace is causing carbon reductions without the Clean Power Plan. Coal generation is being replaced by natural gas and wind generation, and coal-fueled power plants have continued to retire since the Clean Power Plan was stayed. Although the Clean Power Plan is not currently in effect (and is not likely to be reinstated by the current administration), after evaluating the carbon assumptions in the PR future - particularly the level of generation retirement assumed based on these carbon levels - the Applicants agree with the stakeholder vote that the PR future is the most likely of the three futures to occur.

A summary of the key assumptions for each future is included in Table 2.1-3, below. For the PRLE future, all assumptions remain consistent with MISO's PR future, except the Applicants substituted MISO's "Mid" demand and energy forecast from that future with the "Low" demand and energy forecast from the EF future. The Applicants also developed the PRFoxconn future to consider the potential impacts of the new approximately 200 MW load from the Foxconn flat-screen TV manufacturing facility in Mount Pleasant, Wisconsin. In the PRFoxconn future, all assumptions remain consistent with MISO's PR future, except the Foxconn manufacturing facility is added to the model in 2021 and is assumed to be connected to an existing substation in southeastern Wisconsin.

Table 2.1-3: Studied Futures Key Assumptions[18]

	Existing Fleet	Policy Regulations Low Energy	Policy Regulations	Policy Regulations Foxconn	Accelerated Alternative Technologies
Demand and Energy	Low (10/90)	Low (10/90)	Base (50/50)	Base (50/50) + Foxconn	High (90/10)
Natural Gas Price (Nominal Dollars/mmBtu)	Base - 30%	Base			Base +30%
Demand Side Additions (by year 2031)	EE: 0.2 GW DSM: 3 GW	EE: 3 GW DSM: 4 GW			EE: 9 GW DSM: 7 GW
Renewable Additions (by year 2031)	5 GW	22 GW			52 GW
Generation Retirements (by year 2031)	Coal: 8 GW Gas/Oil: 16 GW	Coal: 16 GW Gas/Oil: 16 GW			Coal: 24 GW Gas/Oil: 16 GW

Additional information regarding these futures is contained in the Section 6.1 of the Planning Analysis provided as **Appendix D, Exhibit 1**. The Applicants also updated the MTEP models to include system changes that were planned after the MTEP17 models were finalized. The specific updates the Applicants made are described in Appendix D-12 to the Planning Analysis Document.

Calculation of Economic Benefits

As noted, the Applicants quantified five categories of economic benefits for each alternative: Energy Cost Savings, Capacity Loss Savings, Insurance Value, Avoided Reliability Benefits, and Asset Renewal Benefits. These benefits are described in greater detail below and in Sections 6.2 to 6.7 of the Planning Analysis provided as **Appendix D.**

[18]Source for MTEP17 Future's Key Assumptions
https://www.misoenergy.org/Library/Repository/Study/MTEP/MTEP17/MTEP17%20Full%20Report.pdf

Energy Cost Savings

When a 345 kV transmission line such as the Project is added to the transmission system, the energy market becomes more robust because energy from different generators can travel to different load points more efficiently and without congestion, thereby increasing competition and driving down market prices. This can save energy costs for customers because local load serving entities (LSEs) (such as Wisconsin Power and Light Company (WPL), Madison Gas and Electric Company (MGE), Wisconsin Electric Power Company (WEPCO), Wisconsin Public Service Corporation (WPSC), Dairyland, and WPPI Energy) can now buy power from the regional market at lower prices.

The electric charges to ratepayers, however, include more than just what their LSEs pay for energy purchases in the wholesale market. Ratepayers also must cover operating and maintenance expenses for generating units owned by their LSEs, net of the revenues those generators receive from selling electricity into the market. If a new transmission line lowers market prices in an area, it can narrow the profit margin for the generators located in that area.

Therefore, to estimate the overall Energy Cost Savings from the Project and its alternatives, the Applicants accounted for not only the impact that these alternatives would have on prices in the wholesale energy markets, but also for the lower profit margins that Wisconsin generators would earn due to the addition of a particular alternative. This is generally referred to as an Adjusted Production Cost (APC) analysis and was conducted to determine the Energy Cost Savings for Dairyland's and NSPW's Wisconsin customers. However, for the ATC zone, ATC used its Customer Benefit Metric, which is slightly different than the APC method because it considers financial transmission rights (FTRs) and loss collection/refund charges.

The Applicants used Ventyx's PROMOD software package to determine the Energy Cost Savings benefits for Wisconsin customers from the various alternatives in the five futures. Table 2.1-4 below summarizes the Energy Cost Savings of each alternative in each studied future. Additional information regarding PROMOD and the Applicants' calculation of the Energy Cost Savings for the Project and the studied alternatives is provided in Section 6.2 of the Planning Analysis, provided in **Appendix D**.

Table 2.1-4: Energy Cost Savings ($M – 2018 PV)

	Benefits ($M – 2018 PV)				
	EF	PRLE	PR	PRFoxconn	AAT
NA	0.0	0.0	0.0	0.0	0.0
CHC	38.9	214.6	164.0	187.7	407.8
LVA	35.5	195.2	166.1	198.5	484.2
NTA	32.3	41.4	31.7	17.8	67.4

Capacity Loss Savings

All LSEs in MISO must maintain resource adequacy by owning or contractually acquiring generation capacity to cover their load, assigned transmission losses, and an additional planning reserve margin. Any project that decreases local load or transmission losses, or that increases local generation, would reduce the LSE's overall capacity requirement.

Each of these elements has a capacity value in the MISO market.

For example, a new transmission line such as the Project would likely reduce line losses, thereby reducing each LSE's overall capacity obligation, directly benefitting Wisconsin customers. As energy travels across the conductors on a transmission line, some of that energy is lost as heat. Generally speaking, the more energy that travels across the conductors, the hotter they become and the more energy is dissipated as lost heat. When a new transmission line is built, it often decreases the amount of energy that travels over other existing conductors, thereby decreasing their line losses. This reduction of electrical losses is most acute during times of peak demand. A reduction in line losses during peak demand likewise reduces the amount of capacity the LSE is required to ensure is available. This reduction in the LSE's capacity requirement can reduce its capacity costs, which directly benefits Wisconsin customers.

To calculate these Capacity Loss Savings, the Applicants calculated the difference in the LSE's capacity requirement with and without the alternative. The Applicants then calculated the total cost of the LSE's capacity requirement with and without the alternative based on an estimate of capacity prices over that alternative's useful economic life. The difference in capacity costs with and without the alternative reflects the Capacity Loss Savings for Wisconsin customers.

Table 2.1-5 below summarizes the Capacity Loss Savings of each alternative, which is the same across all studied futures. The NTA's capacity benefits significantly exceed the capacity benefits of the other alternatives considered, and are estimated to be one of the NTA's largest economic benefits in the Planning Analysis.

Additional information regarding the Applicants' calculation of each alternative's Capacity Loss Savings is contained in Section 6.3 of the Planning Analysis provided in **Appendix D**.

Table 2.1-5: Capacity Loss Savings ($M – 2018 PV)

	Future	NA	CHC	LVA	NTA
Capacity Savings Benefit	All Futures	0.0	2.5	1.0	27.1[19]

Insurance Value

A project that strengthens the transmission system also reduces the economic impact of severe generation or transmission outages. For example, if a 345 kV transmission line is constructed and another transmission line or generator goes out of service, the transmission system would generally have greater access to a wider set of generators and, therefore, greater access to lower-cost electricity; consequently, market prices would be lower than they otherwise would have been had the new transmission line not been constructed. To calculate the Insurance Value of the various alternatives, the Applicants estimated the probability and duration of various outages occurring and then used PROMOD to measure the extent to which an alternative will mitigate energy cost increases in the wake of such outages. Table 2.1-6 below summarizes the Insurance Value of each alternative, which is the same across all studied futures.

Additional information regarding the Applicants' calculation of each alternative's Insurance Value is contained in Section 6.4 of the Planning Analysis provided in **Appendix D**.

Table 2.1-6: Insurance Value ($M – 2018 PV)

	Future	NA	CHC	LVA	NTA
Insurance Benefit	All Futures	0.0	6.0	5.8	1.2

[19] The Applicants assumed that the NTA would include 32 MW of utility-scale and rooftop solar generation, and applied a 50 percent capacity credit to that installed solar capacity. This capacity credit is assumed constant over its 40-year useful economic life. If constructed, the capacity credit would be updated after 30 days of summer operating history and could be significantly lower than 50 percent, which would reduce the NTA's Capacity Loss Savings benefit.

2.1.2.2 Avoided Reliability and Asset Renewal Benefits Analysis

The transmission system in southwest and southcentral Wisconsin is not robust as there are a limited number of high voltage transmission facilities in this area, and its reliable operation is affected by transmission system flows of power from the west to the east. Recent generation retirements in the area such as the retirement of the Nelson Dewey units have led to congestion. Even moderate additional wind capacity to the west of Wisconsin would further stress this already constrained system. The transmission system in this geographic area is comprised mainly of 69 kV facilities with some 138 kV and 161 kV facilities intended for local load serving purposes. In addition, much of the existing infrastructure is aging and expected to be replaced in the next 30 years.

As part of the Planning Analysis for the Project, the Applicants evaluated how each alternative would impact the reliability of the transmission system in southwest and southcentral Wisconsin. The Applicants quantified two categories of benefits: Avoided Reliability Benefits and Asset Renewal Benefits, which are described in further detail below. There are also a number of reliability benefits that cannot easily be quantified in dollar terms, and are therefore described qualitatively. As noted in Section 2.1, to ensure that there is no double-counting of benefits, in calculating net economic benefits, the Applicants have only included the higher of either (1) the sum of the Energy Cost Savings benefits and Insurance Value or (2) the combined Avoided Reliability Project and Asset Renewal benefits of each alternative, but not both, in the Applicant's overall cost/benefit analysis.

<u>Avoided Reliability Benefits</u>

All transmission owners are required to maintain an adequate and reliable transmission system that meets the needs of their transmission customers.[20] This is true regardless of whether any of the alternatives are built. However, each of the alternatives would provide a certain level of reliability benefits by, in some cases, obviating the need to build other projects in the future that would have otherwise been necessary for the transmission owner to maintain an adequate and reliable system.

To calculate the Avoided Reliability Benefits of each alternative, the Applicants compared the capital improvements needed to maintain an adequate and reliable system under the No-Action alternative to the capital improvements that would be needed under each of the other alternatives. This analysis identified the Project as a viable solution to many of the reliability concerns in southwest and southcentral Wisconsin for the planning year 2027.

The Applicants conducted a steady state reliability analysis of the transmission system to develop a preliminary list of capital improvements that would be required to maintain an adequate level of reliability under the No Action alternative (i.e., the base case). The Applicants performed this analysis in accordance with the Applicants' planning criteria and the North

[20] NERC Standard TPL-001-4 (http://www.nerc.com/files/tpl-001-4.pdf) for Transmission System Planning Performance Requirements.

American Electric Reliability Corporation (NERC) reliability standards. The Applicants then ran this analysis with a particular alternative included in the analysis to determine if that alternative would eliminate the need for any of the capital improvements in the preliminary list. The sum of the costs for those avoided capital improvements is the Avoided Reliability Benefit for that alternative.

Table 2.1-7 provides cost estimates for the projects that would be needed to eliminate local reliability violations in 2027 under the No-Action alternative.

Table 2.1-7: Conceptual Projects for Thermal Overloads with NLL Contingencies

Overloaded Branch	Line ID	Solution	Capital Cost ($M – 2018)	Avoided Reliability Benefit [1] ($M – 2018 PV)
Turkey River – Stoneman 161 Kv	Q-10	Hickory Creek – Nelson Dewey 345 kV Line [2]	79.5	31.9
Stoneman – Nelson Dewey 161 Kv	Q-2E			
Townline Road – Bass Creek 138 Kv	X-95	Rebuild 9.5 miles [3]	11.2	10.3
Paddock – Townline Road 138 Kv	X-39	Paddock Area Solution [4]	5.4	5.0
Paddock 345/138 Kv	PAD T21			
West Middleton – Timberlane Tap 69 kV	6927	Rebuild 2.0 miles	2.9	2.7
Columbia 138/69 Kv	COL T31	Replace terminal equipment	0.1	0.1
Portage – Columbia 138 kV ckt 1	X-13	Reconductor double circuit	5.0	4.6
Portage – Columbia 138 kV ckt 2	X-20			

1. Avoided Reliability Benefits are the capital costs escalated to the assumed ISD of 12/31/2023, planning-level estimates of revenue requirements are added, and the total is discounted to 2018.
2. The capital cost of Hickory Creek – Nelson Dewey is the cost for the entire solution. The Avoided Reliability Benefit is the PV of all costs to Wisconsin customers. Consistent with the planning level cost estimates of non-MVP alternatives, only the portion of the solution in Wisconsin is assumed to be paid for by Wisconsin customers.
3. The Townline Road – Bass Creek 138 kV normal and emergency rating will be limited by terminal equipment to 246 and 335 MVA for summer normal and summer emergency, respectively. The line itself would be rated 321 and 436 MVA.
4. The Paddock Area Solution is a combination of moving the proposed 5 ohm series reactor from Paddock – NW Beloit to Paddock – Townline Road 138 kV, installing a 6 ohm reactor on Paddock – NW Beloit, and replacing the

Paddock 138/69 kV transformer. The impedance of the reactor could vary slightly with each alternative.

Table 2.1-8 summarizes the reliability projects and costs that would be avoided if a given alternative were constructed.[21] Ultimately, constructing the Project would eliminate the need to construct approximately $42 million in reliability projects and (as described in the Planning Analysis) would also result in avoided overloads on a variety of transmission lines during Load Loss Allowed, P3 and P6 contingencies. Additional information regarding the Applicants' calculation of the Avoided Reliability Benefits for each alternative is contained in Section 6.5 of the Planning Analysis provided in **Appendix D**.

Table 2.1-8: Avoided Reliability Benefits of Each Alternative

	Avoided Reliability Benefit ($M – 2018 PV)			
Overloaded Branch	**BASE**	**NTA**	**LVA**	**CHC**
TUR-SMN Q-10			31.9	31.9
SMN-NED Q-2E				
TLR-BSC X-95			10.3	10.3
PAD-TLR X-39				
PAD T21				
WMD-TLT 6927 [1,2]			2.7	
COL T31				
POR-COL X-13				
POR-COL X-20				
Total	0.0	0.0	44.9	42.2

1. The LVA avoids a rebuild of the West Middleton – Timberlane Tap 69 kV line for both the Avoided Reliability Benefits and the Asset Renewal Benefits. When these benefits are combined, only the Asset Renewal Benefits are included to avoid double-counting this benefit.
2. If the route ordered for CHC completely rebuilds the WMD-TLT 6927 line, then $2.7M in Avoided Reliability Benefit should be added to CHC. This potential benefit is not included to be conservative.

<u>Asset Renewal Benefits</u>

Many transmission lines in southwestern Wisconsin were constructed in the 1950s and many will be candidates for a partial or complete renewal in the future. The 69 kV and 138 kV lines in the Project area are typically either single wood poles or wood H-Frame structures. The lifespan of typical wood construction lines is 60 to 70 years. This lifespan can vary due to several factors

[21] Although the Applicants' steady state analysis modeled reliability violations under a variety of contingencies (e.g., No Load Loss Allowed; Load Loss Allowed; P3 contingencies; and P6 contingencies), the Applicants were conservative by only including those projects that are needed to resolve system conditions due to No Load Loss Allowed events.

including weather, pole deterioration and decay, woodpecker damage, below-grade decay, partially or fully rejected poles, and how well the lines are maintained. An engineering assessment of the existing structures on the various potential transmission routes shows that many of these wood structures are expected to require renewal within the 40-year lifespan of the various alternatives considered in the Applicants' Planning Analysis.

If constructed, the transmission alternatives considered in the Applicants' Planning Analysis (i.e., the Project and the LVA) would involve the replacement and/or refurbishment of various existing transmission components along the chosen route. These are components that would otherwise have to be replaced and/or repaired in the future under the No-Action alternative. Thus, the Asset Renewal Benefits shown in Table 2.1-9 are for system components that would need to be replaced at some point during the next 40 years, but are instead being rebuilt as part of the applicable alternative. Essentially, Wisconsin customers benefit by avoiding the cost of rebuilding these components in the future and by instead including the rebuild as part of the transmission alternative studied in the Applicants' Planning Analysis (i.e., the Project or the LVA).

Table 2.1-9: Asset Renewal Benefits by Alternative Route

	Benefit ($M – 2018 PV)		
	CHC and LVA		NTA
Asset Renewed	Preferred Route	Alternate Route	N/A
X-16	25.9		
Y-138	9.1		
Y-128	9.9		
6927	2.5	3.2	
X-15		23.6	
X-14		7.2	
X-17		10.4	
Y-105		15.2	
Total	47.4	59.6	0.0
Total w/ Margin [1]	45.0	56.6	0.0

1. Avoided projects are assumed to rebuild each line in its entirety. However, portions of each line that enter and exit substations along the route won't necessarily be rebuilt. To account for these portions, only 95% of the rebuild costs are counted as avoided costs.

Table 2.1-10 contains the total Avoided Reliability Benefits and Asset Renewal Benefits by potential route.

Table 2.1-10: Total of Avoided Reliability and Asset Renewal Benefits by Alternative Route

Avoided Project Benefit ($M – 2018 PV)		
CHC and LVA		NTA
Preferred Route	Alternate Route	N/A
87.2	98.8	0.0

2.1.2.3 Improved transfer capability and competition

As discussed previously, the Project would increase the transfer capability into southwest and southeast Wisconsin from Iowa. This increased transfer capability is measured by the difference in the first contingency incremental transfer capability (FCITC). Each of the alternatives except the No-Action alternative would add incremental FCITC, but the Project would provide substantially more incremental FCITC than the LVA and NTA in both the summer peak and shoulder times. As shown in Tables 2.1-11 and 2.1-12**,** the Project would provide approximately 1,300 MW of FCITC while the LVA would only provide about 850 MW and the NTA about 250 MW of FCITC.

Regardless, the increased FCITC of each alternative would increase the competitiveness of the wholesale power market. Structural measures of competitiveness, such as the Herfindahl-Hirschman Index (HHI), are commonly used to evaluate the extent of competition in wholesale power markets. New transmission lines can improve competition in the wholesale power market if they enable external suppliers to offer additional generation into the relevant market. The Applicants used the HHI to evaluate the competitiveness of the wholesale energy market in the ATC footprint (i.e., the Wisconsin-Upper Michigan System, or WUMS) with and without the studied alternatives. The Applicants analyzed the competitiveness of WUMS (instead of all of Wisconsin) because WUMS has been and will likely continue to be designated as an area with market constraints, or a "Narrow Constrained Area." Indeed, the Independent Market Monitor for MISO has designated WUMS as one of the least competitive market areas within MISO. Improving the competitiveness of this area would therefore be particularly beneficial to customers.

The Applicants' HHI analysis indicates that, more so than any other alternative studied, the Project will reduce market concentration and increase competition in the wholesale energy market for the WUMS region.

Tables 2.1-11 and 2.1-12 summarize the Applicants' calculation of the change in Net HHI during the summer peak period and shoulder period in 2027. Markets in which the HHI is between 1000 and 1800 points are considered to be moderately concentrated, and those with an HHI in excess of 1800 points are considered to be highly concentrated. Thus, if an alternative reduces net HHI, then it increases competition in the relevant market.

Table 2.1-11: 2027 Summer Peak Net HHI

		Net HHI		
Alternative	Incremental FCITC (MW)	NA	With Alternative	Change in Net HHI
NA	0.0	1011	1011	0
CHC	1382.0	1011	918	(93)
LVA	980.3	1011	935	(76)
NTA	170.0	1011	993	(18)

Table 2.12-12: 2027 Shoulder Net HHI

		Net HHI		
Alternative	Incremental FCITC (MW)	NA	With Alternative	Change in Net HHI
NA	0.0	1652	1652	0
CHC	1231.0	1652	1421	(231)
LVA	784.9	1652	1492	(160)
NTA	334.2	1652	1578	(74)

2.1.2.4 Qualitative Benefits

In addition to the economic benefits described above, the Project will provide numerous other public policy benefits that cannot be quantified. These qualitative benefits are briefly discussed below, and additional detail regarding these benefits is described in Section 7.0 of the Planning Analysis provided in **Appendix D**.

Qualitative Reliability Benefits

The transmission alternatives will generate additional reliability benefits that cannot be or were not quantified as part of the Applicants' Planning Analysis. Some of these benefits are described qualitatively below and in Section 7.0 of the Applicants' Planning Analysis provided in **Appendix D**.

- Voltage Stability: Although the Applicants did not study the impact of the Project or the LVA on voltage stability, previous Definitive Planning Phase (DPP) studies conducted by MISO indicate that the Project will have voltage stability benefits.

- Elimination or Reduced Use of Operating Guides: An operating guide consists of pre-planned procedures that are initiated under pre-determined operating conditions of the transmission system to alleviate conditions such as line overloads. Operating guides are normally used as interim measures and are not normally long-term solutions. In addition to supporting system reliability for the wide range of contingencies and system conditions discussed in the previous sections, CHC and the LVA will also reduce or completely eliminate three operating guides, some of which exist due to the risk of cascading outages in southwestern and southcentral Wisconsin for some P6 and P7 contingencies. For example, when the Nelson Dewey (nameplate 220 MW) and Stoneman (nameplate 40 MW) power plants located in Cassville, Wisconsin, ceased operations in 2015, these plant closures changed the electricity flows on the regional grid in southwestern Wisconsin and increased the reliance on the local transmission system due to the need to bring electricity from more remote generation sources to maintain local electric service. Dairyland, ATC, and MISO had to establish operating guides to control how much power flows through the transmission lines in southwestern Wisconsin under certain operating conditions. MISO operating guides, which are currently being used to maintain equipment loading within limits and protect the customers of Dairyland and other local utilities, would no longer be needed if CHC is constructed. The Project (and potentially the LVA) would also reduce the frequency of implementation, or possibly eliminate, an existing operating guide for a long 69 kV path from the border of Iowa and Illinois to southwestern Wisconsin. This guide prevents the line from becoming overloaded during hot summer days.

  While operating guides may be an acceptable way to maintain a reliable transmission system, they add complexity to real-time operations and, in some instances, require reliability to be maintained by interrupting service to load or generation. It is a clear benefit to limit the number of operating guides and/or the complexity within each operating guide.

- Congestion Related to Long Term Plant Outages: In the MISO day-ahead and real-time energy markets, a certain transformer in southwest Wisconsin has frequently been a bound constraint in 2016 and 2017. This constraint is a thermal limit for system intact conditions, meaning the power flowing through the transformer reaches its continuous rating without prior outages. During the second half of 2016 and the first half of 2017, all three units at the Riverside Energy Center were unavailable due to an extended outage. This outage, along with less than 100 percent dispatch of the Columbia power plant, resulted in very frequent congestion of the transformer. By August 2017, both plants were generally available and frequently dispatched, which resulted in less frequent congestion of the transformer.

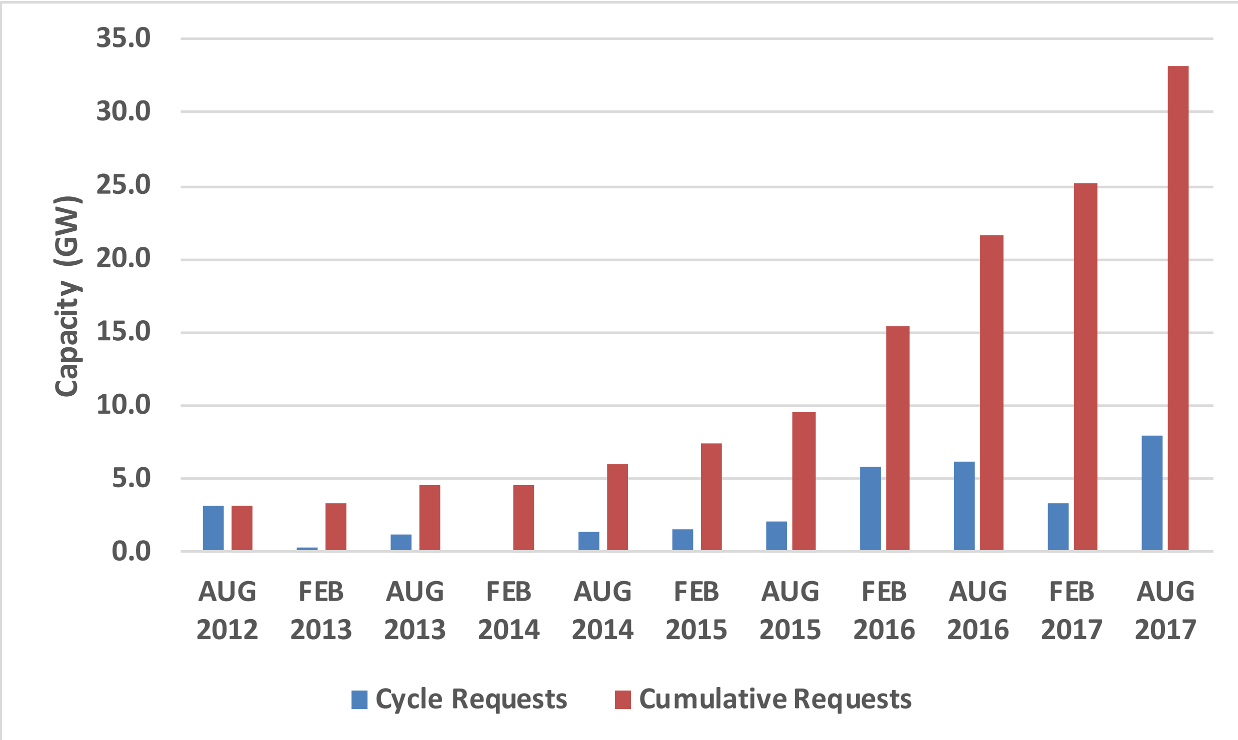
  The Project will eliminate this market congestion by providing an alternate 345 kV path from Iowa to the Madison area and by having an intermediate substation in southwestern Wisconsin. The LVA will also provide an alternate path around the congested facility. The utility-scale solar plant associated with the NTA was intentionally interconnected in a certain location to limit this congestion. However, the NTA will only limit the congestion when the solar plant is providing a significant amount of power to the system, which is when the sun is shining. The NTA does not provide a permanent path for power from Iowa to bypass this congestion into Wisconsin.

- Maintenance Outage Coordination: Currently there are various limits in southcentral and southwestern Wisconsin related to the ability to take maintenance outages. As a new 345 kV line from Iowa to the Madison area with an intermediate substation in southwestern Wisconsin, the Project will increase the availability of periods for maintenance outages by reducing flows and supporting local voltage. The LVA will similarly improve maintenance outage coordination. The NTA will not improve maintenance outage coordination because it does not renew any transmission assets or provide new transmission assets.

New Generation Contingent On the Project

As shown in Figure 2.1-5, the total capacity of generator interconnection requests in the MISO West Area is generally increasing and has cumulatively reached more than 30 GW since the August 2012 cycle, with 25 GW alone requesting interconnection between the August 2015 and August 2017 cycles.

Figure 2.1-5, MISO West Area Generator Interconnection Requests

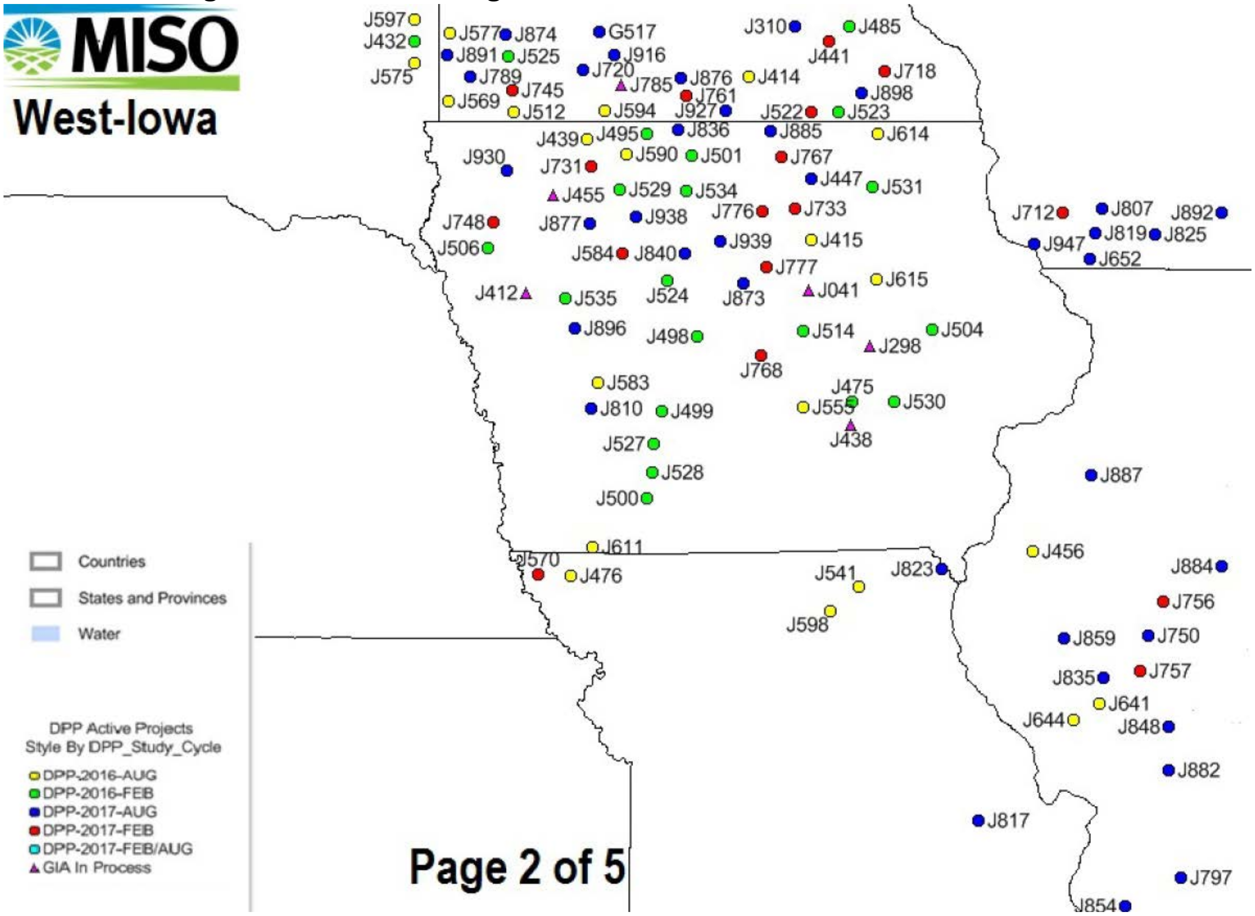


As the geographic diversity of wind resources in MISO increases, so does the average wind output available at any given time.[22] Therefore, by increasing transfer capability, the Project would provide an outlet for as much as 25 GW of wind resources in Iowa including those that may be owned by or subject to one or more PPAs with Wisconsin utilities. While the LVA would slightly increase the output of those generators, the NTA would have no effect.

Moreover, a large amount of new, primarily low-cost wind generation is being developed in the upper Midwest that is contingent upon the development of the Project. Figure 2.1-6 below from MISO shows the various generation facilities that were active in the interconnection process as of March 23, 2018:

[22] "Wind variability over a large geographic area is reduced by a factor of 3 when larger amounts of wind are spread over a large geographic area." Lessons Learned in Wind Generation, Dale Osborn, MISO, https://ccaps.umn.edu/documents/cpe-conferences/mipsycon-papers/2013/lessonslearnedinwindgeneration.pdf. *See also* 2017 MVP Triennial Review, pp. 37-38.

Figure 2.1-6: Generating Facilities In Active Interconnection Process



Specifically, MISO has conditioned the output from, and/or interconnection of, numerous generators on the completion of the Project. More than a dozen of these are low-cost wind facilities, which benefit both consumers and the environment. Because only the Project is referenced in the Generator Interconnection Agreements (GIAs) for these generators, this benefit does not apply to any of the other alternatives studied in the Planning Analysis.

Flexibility in the Face of Changing Conditions in the Electric Power Sector

The United States' electric industry is experiencing unprecedented change in its generation portfolio due to market conditions and public policies, such as state RPSs, federal tax incentives, and federal energy and environmental regulations. The Project provides a high-voltage backbone in southwest Wisconsin, which currently lacks any 345 kV infrastructure. As a result, the Project will allow the local system to respond more flexibly to a rapidly changing mix of future generation projects and load additions, which are influenced by both market conditions and state and federal policies. Even in the unlikely scenario that the local and regional generation mix remains unchanged in the next 40 years, the Project will provide a strong backbone connection that will support variation in fuel prices for commodities such as natural gas and coal. And regardless of the activity surrounding fuel prices, the Project will facilitate a less constrained market as part of a strong transmission network that can support a variety of generation dispatch assumptions.

Hedge Against Volatile Natural Gas Prices

Historically, natural gas prices have been volatile, which can dramatically increase energy costs to Wisconsin consumers. By increasing transfer capability between high-wind areas in Iowa and Wisconsin, the Project would decrease the risks to Wisconsin customers that arise from fluctuations in natural gas prices. Although the LVA would also provide some value as a hedge against volatile natural gas prices, its benefit in this regard is decreased because it has a smaller impact on transfer capability. The NTA does not affect transfer capability as significantly as the Project or the LVA and would therefore not be as effective in reducing the risk of natural gas price volatility to Wisconsin customers.

Reserve Requirements

Of the alternatives evaluated, the Project is also the best means of helping Wisconsin utilities meet reserve requirements. Specifically, the Project would eliminate the Zone 2 capacity import limit of the Stoneman-Nelson Dewey 161 kV for a certain nearby outage, which was identified in the *Planning Year 2017-2018 Loss of Load Expectation Study Report.* Capacity import limits are specified by MISO and represent the amount of electricity (in MW) that can be reliably imported into a specific local resource zone.[23] In setting the capacity import limit, MISO considers the import and export capabilities of the existing grid.

Capacity import limits can potentially limit the ability of a MISO zone to import capacity in an annual auction, thereby diminishing the reserves for that zone. Therefore, if the local balancing authorities in Zone 2 (the ATC footprint) were short on capacity, then being able to import capacity from Zone 3 (primarily in Iowa), and Zone 1 (including western Wisconsin and Minnesota) would contribute to Zone 2's reserve requirements.

The NTA would not eliminate this capacity import limit and would therefore not provide any reserve requirement benefits.

2.1.3 Summary Comparison of Alternatives

Of all the alternatives analyzed, the Project provides the most net benefits from an economic, reliability, and public policy perspective. The Project will increase the power transfer capability between Iowa and Wisconsin; facilitate the delivery of low-cost energy and capacity into Wisconsin from areas west of the state; avoid the need to construct millions of dollars in reliability projects and transmission upgrades; and provide a suite of additional reliability and public policy benefits to Wisconsin customers. Moreover, because MISO has included the Project as part of the MVP portfolio, the cost of the Project will be spread across the MISO

[23] MISO, Business Practice Manual 020-r12, (April 2015), § 8.3.8.4, retrieved from https://www.misoenergy.org/Library/BusinessPracticesManuals/Pages/BusinessPracticesManuals.aspx, § 4.3.8.4

footprint. Wisconsin customers effectively stand to receive the benefits of the Project at a substantial discount.

The LVA is inferior to the Project, from both a quantitative and qualitative perspective. Although the LVA would provide a 138 kV outlet from Cassville to Middleton, it has a lower overall economic benefit and would not increase the power transfer capability between Iowa and Wisconsin to the same degree as the Project. The LVA is also not an approved MVP and its costs are therefore unlikely to be spread across the MISO footprint. Moreover, there are a variety of planning studies, models, and generator interconnection agreements that have assumed the Project will eventually be constructed. If the LVA was constructed in lieu of the Project, many of these studies would need to be reviewed and could identify the need for additional transmission upgrades. Finally, it is unlikely that the LVA would be permitted and constructed on the same schedule as the Project, resulting in a delay of benefits to Wisconsin customers. In a best-case scenario, the LVA would have an estimated in-service date in 2025.

The NTA is also an inferior alternative to the Project. By definition, this alternative does not involve the construction of any additional transmission facilities, and would therefore do little to reduce transmission congestion or improve power transfer capability between Iowa and Wisconsin. In this way, the NTA would not provide Wisconsin customers with access to low cost, renewable energy generated west of Wisconsin. The NTA also does not provide any of the reliability benefits that the Project and the LVA would provide.

The preferred alternative should provide significant quantitative benefits while achieving as many of the qualitative benefits as possible. The Project demonstrates excellent quantitative results. It also scores well in the qualitative measures. Therefore, when factoring in all the pertinent quantitative and qualitative results, the Project is the preferred alternative and meets the CPCN requirement to satisfy the reasonable needs of the public for an adequate supply of electric energy.

2.2 Transmission Network Alternatives

The Applicants considered and rejected several 345 kV alternatives to the Project. To qualify as a transmission alternative to the Project, a substitute project should connect the end points for this MVP—namely, northeastern Iowa and the 345 kV network in southcentral Wisconsin near Madison—and cost effectively increase the transfer capability from northeast Iowa to southwestern and southcentral Wisconsin, reduce congestion, increase reliability, and support public policy. However, there are a limited number of locations to site a transmission line that satisfy these criteria, and the Applicants identified the Project as the alternative that satisfies these criteria in the most cost-effective and beneficial manner.

At the southern end of the Project, the Mississippi River divides northeastern Iowa from southwestern Wisconsin. After years of study, the Applicants concluded that the only feasible routes for crossing the Mississippi River between these two endpoints was near Cassville, Wisconsin. Thus, the Wisconsin portion of any 345 kV alternative must begin in Cassville.

At the northern end, potential endpoints include the Cardinal, North Madison, Rockdale, Kitty Hawk, and Paddock substations. However, neither the Kitty Hawk Substation nor the Paddock Substation are connected to the 345 kV network in the Madison-area. Based on discussions with MISO in the Fall of 2017, an alternative that terminated at either of these endpoints would not be considered electrically similar enough to the Project and would likely not qualify for MVP status. This means either alternative would have to be evaluated as a new project in the MISO MTEP process. Therefore, a transmission alternative that terminates at the Kitty Hawk or Paddock substations would not be viable when compared with the Project and the Applicants eliminated it from consideration.[24]

A transmission alternative that terminates at the Rockdale or North Madison substations would likewise be an unsuitable alternative to the Project. Such an alternative would be longer and more expensive than the Project, would have a later in-service date, and (based on discussions with MISO in the Fall of 2017) also may not be considered electrically similar enough to the Project to qualify for MVP status. Given the higher costs, later in-service date, and the uncertainty of MVP treatment, the Applicants eliminated a transmission alternative that terminates at the Rockdale or North Madison substations from further consideration.

This leaves the Project as the most feasible, cost-effective high-voltage transmission alternative for connecting the transmission systems in northeastern Iowa and southcentral Wisconsin.

2.3 Local Transmission, Distribution and Distributed Resource Alternatives

Section 2.1.2.1 of this Application describes the low-voltage transmission alternative that the Applicants studied in their planning analysis for the Project. For the same reasons noted in Section 2.2, above, any low voltage alternative would have the same Iowa facilities as the Project and its western terminus in Wisconsin would be located in Cassville. The low voltage alternative that provides the greatest potential economic and public policy benefits follows the same basic route as the Project, and the Applicants studied the economic and reliability benefits of this alternative as part of their Planning Analysis. However, the Applicants determined that the Project would provide a greater net benefit to Wisconsin customers than the LVA. Moreover, MISO stated that a suite of low-voltage alternatives would not be considered part of the 2011 MVP portfolio, and would therefore not be eligible for cost-sharing under the MVP tariff. Other low-voltage alternatives were therefore eliminated from consideration.

2.4 Non-Transmission Options

For a non-transmission alternative to be even roughly comparable to the Project, it must, among other things, improve the reliability of the regional electric system; reduce energy delivery costs by alleviating transmission congestion; increase transfer capability between Iowa

[24] There are also reliability and cost-related concerns with a transmission alternative that terminates at the Kitty Hawk and Paddock substations. For additional details, please see Appendix D, Section 5.4.1.

and Wisconsin; and increase flexibility in responding to changes in public policy. It is difficult to design a non-transmission alternative that can provide these multiple benefits. By definition, non-transmission alternatives such as energy efficiency, demand response, and renewable or conventional generation would not directly link the high-voltage transmission systems in Iowa and Wisconsin. As a result, these options would have little impact on power transfer capability or transmission congestion, and would do little (if anything) to facilitate the import of low-cost energy into Wisconsin. Moreover, these options would not have the same reliability benefits as the Project; this is because transmission upgrade and maintenance projects that would otherwise be avoided if the Project were constructed would become necessary to maintain system reliability.

That said, the Applicants studied a variety of non-transmission alternatives, in accordance with the Energy Priorities Law in Wis. Stat. § 1.12(4), as part of their planning analysis, including energy efficiency, demand response, and renewable and conventional generation. As noted, as part of the planning analysis for the Project, the Applicants studied a non-transmission alterative, which included energy efficiency, demand response, and local renewable energy. The MTEP futures that the Applicants used in their planning analysis also included various assumptions regarding the future implementation of energy efficiency and demand response measures and the mix of generating resources in the MISO footprint, as these factors could affect the benefits and costs of the Project. As discussed in Section 2.1 and in further detail below, the Applicants' analysis indicates that, across all futures, the Project generates the greatest amount of net benefits for Wisconsin customers, relative to the studied alternatives. Therefore, non-transmission options are not feasible or cost-effective alternatives to the Project.

2.4.1 Noncombustible Renewable Energy Resources

Because the Project and LVA alternatives would substantially increase the transfer capability from high wind and currently constrained areas of Iowa to southwest and southcentral Wisconsin, these alternatives would likely lead to substantially more low-cost wind energy use in Wisconsin.

The Applicants also evaluated utility-scale and distributed solar generation as part of the NTA described in Section 2.1 of this Application. The Applicants assumed that this NTA would have roughly the same ratepayer cost as the Project (approximately $70.3 million in 2018 dollars). By doing so, the Applicants could evaluate how an NTA with costs comparable to the Project performs in bolstering reliability, reducing congestion, increasing transfer capability, and providing flexibility for future public policies. As discussed above, the studied NTA does not produce benefits that are comparable to those produced by the Project and the Applicants therefore eliminated it as a viable alternative.

The Applicants also considered energy storage as a non-transmission alternative, but determined that it is likewise insufficient to address the needs the Project is intended to address. Theoretically, a large portfolio of batteries could be designed to provide similar levels of reliability as the Project and to increase transfer capability by charging or discharging energy, depending on the storage location, when additional transfer capability is required. But a very large amount of storage would be required to replace the increased transfer capability that would be provided by the Project. That volume of storage could only be provided by pumped hydro, compressed air, or molten salt, none of which is available in Wisconsin due to Wisconsin's geographic features. Multiple storage installations at a variety of locations would be necessary. Widespread utility-scale energy storage projects by means of electric batteries are still too expensive to be considered as a reasonable alternative to the Project. Moreover, all forms of storage result in lost energy and there would also be losses on the low-voltage lines for transmission to and from the batteries. Finally, MISO treats energy storage projects as both generators and loads in the interconnection process such that a large electric battery would likely require new transmission upgrades if connected to a relatively weak transmission system. Due to all of these factors, energy storage was not included in the design of the NTA for the Planning Analysis.

Noncombustible renewable energy resources would not produce the same level of Energy Cost Savings benefits, reliability benefits, or public policy benefits that the Project would produce; therefore, they are not feasible or cost-effective alternatives to the Project.

2.4.2 Combustible Renewable Energy Resources and Nonrenewable Combustible Energy Resources (Natural Gas, Oil, Coal with a Sulphur Content of Less than One Percent, and Other Carbon-Based Fuels)

Additional generation, whether combustible renewable or nonrenewable combustible, would also not produce the same level of Energy Cost Savings benefits, reliability benefits, or public policy benefits that the Project would produce. Generating resources would do little (if anything) to facilitate the transfer of low cost energy and capacity from Iowa into Wisconsin or resolve the reliability constraints on the high-voltage transmission system in southwest and southcentral Wisconsin. Therefore, the Applicants rejected additional generation resources as viable alternatives to the Project.

2.5 No-Build Options

As part of the planning analysis described in Section 2.1, the Applicants compared the Project, the LVA, and the NTA against a No Action alternative. In other words, the No Action alternative was the base case against which other electrical alternatives were compared to determine their benefits and costs. Because the planning analysis produced more favorable results with the Project than it did without the Project, the No Action alternative is economically inferior to the Project. In addition, the Applicants considered the ability of each alternative, including the No Action alternative, to increase transfer capability between Iowa and Wisconsin and to improve transmission system reliability. The No Action alternative would result in no change in transfer capability, no improvement in transmission system reliability, and no economic or public policy benefits to customers. Therefore, the No Action alternative is not a feasible or cost-effective alternative to the Project.

2.6 Energy Conservation/Efficiency and Load Response

2.6.1 Energy Efficiency Required to Reduce, Alter, or Eliminate the Need for the Project

As noted above, it is difficult to determine how much energy efficiency and demand response would be necessary to reduce, alter, or otherwise eliminate the need for the Project. This is because the Project generates economic, transfer capability, reliability, and public policy benefits for Wisconsin customers that energy efficiency and demand response either cannot provide at all or cannot provide in amounts that are comparable to the Project.

As stated above, the Applicants studied a non-transmission alternative to the Project, which included energy efficiency (in the form of more efficient lighting) and demand response (in the form of interruptible load). The MTEP futures the Applicants used also assumed varying levels of energy efficiency and demand response in the future. Thus, in addition to studying energy efficiency and demand response as a distinct alternative to the Project, the Applicants also tested the benefits of the Project in futures with aggressive assumptions about energy efficiency and demand response.

The Applicants' planning analysis demonstrates that, across all futures studied, the Project is superior to the NTA and generates benefits even in those futures with aggressive assumptions regarding future implementation of energy efficiency and demand response. Whereas the Project would increase the transfer capability between the high-voltage transmission systems in Iowa and Wisconsin and improve the reliability of that transmission system, the NTA would not. The NTA also does not improve competition in the wholesale energy market to the same degree as the Project, nor does it provide flexibility to address future public policy changes. Finally, the NTA provides less economic benefits (Energy Cost Savings, Capacity Loss Savings, and Insurance Value) in comparison to its costs than the Project under all five studied futures. Therefore, energy efficiency and demand response are not viable alternatives to the Project.

2.6.2 Feasibility of Achieving Energy Efficiency to Reduce, Alter, or Eliminate the Need for the Project

As stated in Section 2.1, as part of the NTA, the Applicants used engineering judgment to select an amount of energy efficiency and demand response that could practically be implemented in southwest and southcentral Wisconsin. The Applicants designed the NTA to have roughly the same cost to Wisconsin customers as the Project; this allowed the Applicants to determine whether an NTA with a cost comparable to the Project would generate greater or fewer benefits than the Project. As noted above, the Project outperformed the NTA in every respect; namely, net economic benefits, reliability, transfer capability, and flexibility to address future public policy changes. Although the planning analysis could have assumed additional energy efficiency and demand response implementation, this assumption would increase the overall cost of the NTA, which would further diminish its comparability with the Project.

Moreover, most current energy efficiency and load reduction programs are voluntary, and thus lack the certainty of a specific infrastructure project like the Project. In addition, transmission-only companies such as ATC and ITC Midwest do not have retail electric customers and do not have the ability to curtail retail load (except through actions of load-serving entities under emergency conditions). Thus, energy efficiency and demand response cannot feasibly and cost-effectively provide the same package of diverse benefits as the Project.

2.7 Market Efficiency Projects

The Project is not a Market Efficiency Project under the MISO tariff.

2.8 Modeling Information

Power System Simulator for Engineering (PSS®E) models were used to analyze the impact of the Project on reliability and to assess what transfer capabilities it would provide to the transmission system. Because some of the information in those analyses is not publicly available, the results of the reliability and transfer capability analysis in the Planning Analysis have been submitted with a request for confidentiality. PROMOD models were used for the economic evaluation and have also been submitted with a request for confidentiality.

2.9 Area Load Information

Coincident peak loads at substations in southwest Wisconsin for the years 2007 through 2017 and forecast loads for the years 2018, 2022, and 2027 are provided in **Appendix D-8**.

2.10 Regional Transmission Organization Information

2.10.1 Cost Benefit Analysis and Cost Allocation

In December 2010 and October 2011, FERC approved MISO's MVP Tariff, which provides for regional cost-sharing of transmission projects that meet each of the following criteria:

- Criterion 1: The MVP must enable the transmission system to deliver energy reliably and economically in support of documented federal or state energy policy mandates or laws.
- Criterion 2: The MVP must provide multiple types of economic value across multiple pricing zones with a total cost/benefit ratio prescribed in Attachment FF of the Tariff.
- Criterion 3: The MVP must address at least one transmission issue associated with a projected violation of a North American Electric Reliability Corporation (NERC) or Regional Entity standard and at least one economic-based transmission issue that provides economic value across multiple pricing zones.[25]

MISO staff subsequently analyzed and recommended a set of MVP projects, including the Project, for inclusion in Appendix A of the 2011 MTEP. These MVP projects were approved by the MISO Board of Directors on December 8, 2011, and the BOD directed transmission owners

[25] MISO, Multi Value Project Portfolio: Results and Analyses (January 10, 2012), § 3.1, retrieved at https://www.misoenergy.org/Library/Repository/Study/Candidate%20MVP%20Analysis/MVP%20Portfolio%20Analysis%20Full%20Report.pdf

to use due diligence to construct the facilities approved in the plan. The Applicants used the MISO Tariff (including the MVP Tariff and the Network Service Tariff) to calculate the Project costs that will be included in the revenue requirement for their customers.

Because the Project has been designated an MVP project, a large portion of its revenue requirement will be allocated across the MISO region. As a result, the Project's net present value revenue requirement to Wisconsin customers is approximately $66.2 million, even though it has an estimated capital cost of approximately $492 million. And as noted in Section 2.1, the Project's benefits clearly outweigh its costs to customers.

Comprehensive details of the cost-benefit analysis for the Project and its alternatives is contained in the Planning Analysis.

2.10.2 Applicable Transmission Tariffs

The Applicants used the MISO Tariff (including the MVP Tariff and the Network Service Tariff) to calculate Project costs, which would be included in the revenue requirement of customers in the State of Wisconsin.

2.10.3 Transmission Service Agreements

This is not applicable to this proceeding.

3.0 MAGNETIC FIELDS

At the Applicants' direction, magnetic field studies were performed and a report prepared. The report is included as **Appendix G, Exhibit 1**.

Transmission Line

As required by Section 3.0 of the Transmission Line Application Filing Requirements, magnetic field profiles were prepared for each given segment and circuit configuration for the proposed transmission line. The configuration of the proposed transmission line within any route segment may vary depending on the transmission line route and segment alternatives chosen, the presence or absence of existing transmission and distribution facilities, and other constraints. The electromagnetic field (EMF) study report provides the location of each unique facility configuration and profile developed, including pre-construction profiles where there are existing electric transmission or distribution lines. Tables in the EMF study report provide a cross reference identifying the locations and facility configuration. The figures in the EMF study report identify the existing (if any) configuration of transmission and distribution facilities and the final facility configurations at each location. The tables also provide the associated calculated magnetic field profile for each existing configuration as applicable and proposed configuration, as well as the estimated current levels at 80 and 100 percent of peak load in the first and 10 years post-construction.

The figures in the EMF studies identify the facility configuration along the line segments and contain the modeling assumptions including: the conductor Phase ID and assumed phase angles; a pole design diagram identifying the dimensions of pole arms and conductor locations, the horizontal distance from the conductors to the poles and the height of all conductors above ground at mid-span. Where underground electric lines exist, the assumed distance below the ground surface is provided.

Substation

As requested in Section 3.0 of the Substation Filing Requirements, the magnetic field readings were taken at the Cardinal, Eden, Nelson Dewey, Lancaster, and Stoneman substations. The measurements are provided on diagrams of the substations in Attachment E to the EMF report.

4.0 PROJECT COSTS

4.1 Transmission and Substation Route Cost Estimates

The following table provides the cost estimates for the Preferred and Alternate Routes between the Mississippi River crossing and Hill Valley Substation and between the Hill Valley and Cardinal substations. Listed separately from the transmission line costs are the costs for each impacted substation and other project costs. The dollars are based on the projected in-service year, 2023. To align with Commission guidance, the Applicants present these costs as a +10%/-30% estimate.

Post-order, the Applicants will update the cost tables to reflect which owner is managing which costs. All Applicants will continue to minimize ratepayer impact by seeking to limit cost wherever possible.

PROJECT COST CATEGORY	Preferred	Alternate
Transmission Lines Mississippi River Crossing (Nelson Dewey) to Hill Valley Substation		
Material	$ 45,426,000	$ 66,758,000
Labor	$ 61,948,000	$ 90,745,000
Other*	$ 26,323,000	$ 34,865,000
Transmission Lines Subtotal	$ 133,697,000	$ 192,368,000
Transmission Lines Hill Valley Substation to Cardinal Substation		
Material	$ 50,055,000	$ 36,664,000
Labor	$ 106,990,000	$ 102,231,000
Other*	$ 34,806,000	$ 36,827,000
Transmission Lines Subtotal	$ 191,851,000	$ 175,722,000
TRANSMISSION LINES TOTAL	$ 325,548,000	$ 368,090,000
Substations		
Cardinal		
Material	$ 1,112,000	$ 1,112,000
Labor	$ 1,437,000	$ 1,437,000
Other		
Subtotal	$ 2,549,000	$ 2,549,000
Eden^		
Material	$ 127,000	$ 127,000

PROJECT COST CATEGORY	Preferred	Alternate
Labor	$ 497,000	$ 497,000
Other		
Subtotal	$ 624,000	$ 624,000
Hill Valley		
Material	$ 14,511,000	$ 14,511,000
Labor	$ 17,691,000	$ 17,691,000
Land Purchase	$ 899,000	$ 899,000
Subtotal	$ 33,101,000	$ 33,101,000
Nelson Dewey		
Material	$ 498,000	$ 498,000
Labor	$ 1,254,000	$ 1,254,000
Other		
Subtotal	$ 1,752,000	$ 1,752,000
Stoneman		
Material	$ 10,000	$ 10,000
Labor	$ 238,000	$ 238,000
Other		
Subtotal	$ 248,000	$ 248,000
SUBSTATIONS TOTAL	$ 38,274,000	$ 38,274,000
Other Project Costs		
Pre-certification Costs - ATC	$ 16,000,000	$ 16,000,000
Pre-WI Order Costs - ITC	$ 10,490,000	$ 10,490,000
Pre-WI Order Costs - DPC	$ 1,577,000	$ 1,577,000
AFUDC-ITC	$ 18,779,000	$ 25,820,000
AFUDC-DPC	626,000	626,000
Post-WI Order Costs - DPC[X]	$2,035,000	2,035,000
Impact Fees		
One-time Environmental Impact Fee	$ 14,082,000	$ 15,249,000
Annual Impact Fee (during construction)	$ 1,914,000	$ 1,944,000
OTHER PROJECT COSTS TOTAL	$ 80,760,000	$ 88,998,000

PROJECT COST CATEGORY	Preferred	Alternate
PROJECT COST - WISCONSIN	$ 444,582,000	$ 495,362,000
PROJECT COST - IOWA	$ 62,891,000	$ 62,891,000
TOTAL PROJECT COST	$ 492,216,000	$ 542,996,000

*The Other transmission line cost category includes real estate costs and construction matting.

^The Eden Substation costs include the installation costs of grounding improvements at the Wyoming Valley Substation.

[X] Post-Order costs for ATC and ITC are included in the transmission line and substation costs. Dairyland is not managing construction of facilities in Wisconsin so Dairyland's costs are included as a separate line item.

4.2 345 kV Project

In accordance with previous Commission rulings under Wis. Stat. § 196.491(3)(gm), the 345 kV transmission line costs and the substation costs regardless of transmission voltage are used in calculating the one-time environmental and annual impact fees. These costs and the method for determining these costs are provided in **Section 7.10**.

5.0 ROUTE, SITE, AND CONSTRUCTION INFORMATION

5.1 Routing and Siting Factors

General Description of Routing and Siting Process

To identify the routes proposed in this Application, the Applicants used a robust, multi-stage routing and siting process. Early in the Project's development, the Applicants established a Project team with extensive expertise in the relevant subject areas that go into identifying and evaluating routes. The Project team identified a study area that encompassed all likely corridors that would meet the system configuration requirements of connecting a 345 kV transmission line between southwestern and southcentral Wisconsin. The study area comprised more than 1,100 square miles between southwestern Grant County and northern Dane County. The study area considered is shown in **Appendix A, Figure 2**.

To narrow the Project study area first to potential corridors, then to preliminary potential routes, revised preliminary routes, and finally to the proposed routes, the Applicants reviewed maps, aerial imagery and other geographic information; evaluated engineering, constructability, environmental, and cost considerations for potential segments; performed field inspections (where feasible) and conducted a lengthy public participation process. As described in **Section 7**, the Applicants solicited input from local landowners, public officials and other stakeholders at various stages to identify issues and concerns with potential transmission line corridors and routes. The Applicants consulted with municipal, county, state, and federal agencies including the PSCW, WDNR, WisDOT, DATCP, Dane County Parks, ACOE, USFWS, National Park Service (NPS) and the RUS. In addition to the Applicants' public participation process, as part of the National Environmental Policy Act (NEPA) process, the RUS also conducted public scoping meetings for the Project.

From a high-level, the routing and siting process generally consisted of:

1. Identifying potential route corridors between established end points meeting Wisconsin's statutory transmission siting priorities. As defined in Wis. Stat. § 1.12(6), electric transmission facilities are to be sited "consistent with economic and engineering consideration, reliability of the electric system and protection of the environment" in accordance with the following priorities, listed in order of priority:

    a. Existing utility corridors.

    b. Highway and railroad corridors.

    c. Recreational trails to the extent the facilities may be constructed below ground and do not significantly impact environmentally sensitive areas.

    d. New corridors.

    The Applicants also sought to identify routes that use existing rights-of-way "to the extent practicable." The Applicants also developed routes and design of the Project in a way that "minimizes environmental impacts in a manner that is consistent with achieving reasonable electric rates." Wis. Stat. Section 196.491(3)(d)3r.

2. Screening possible transmission line routes against several criteria, including those specified in Wis. Stat. § 196.491(3)(d). The Applicants evaluated these elements for their presence in the Project area and their relative suitability for the construction, operation, and maintenance of a transmission line. The Applicants refined these considerations using collected data, information gathered from initial agency contacts, and public comments.

   To the extent practical, these criteria included, but were not limited to the following:

   - Locations of existing linear infrastructure;
   - Use of existing ROWs to minimize the need for additional facility ROW (corridor sharing);
   - Locations of cemeteries, schools, daycare facilities, and hospitals;
   - County and state road expansion plans;
   - Community and landowner impacts, including proximity to residences;
   - Environmental and natural resource impacts, including impacts to wetlands, waterways, and woodlands;
   - Archeological and historic resource impacts;
   - Avoidance of airports and airstrips;
   - Avoidance of high-density residential areas;
   - Conformance with existing and proposed land-use patterns;
   - Consideration of existing conservation easements (where known);
   - Design modifications and/or construction practices necessary to overcome terrain or other physical challenges; and
   - Compatibility with local agricultural practices.

   The above criteria are not listed in order of priority and each criterion was evaluated based on the specific circumstances.

3. Soliciting input from local landowners, public officials and other stakeholders at various stages in the process to identify issues and concerns with potential transmission line corridors and routes.
4. Performing a multidisciplinary review and evaluation considering and balancing the quantitative as well as qualitative factors discussed above along with design, engineering, environmental, economic, and operational considerations.

Application of Routing and Siting Process to the Project

Identifying the Project Study Area

As discussed in the Planning Analysis provided in **Appendix D, Exhibit 1**, the Applicants determined that an intermediate substation in the Montfort, Wisconsin, area was the most appropriate from an electrical and routing and siting perspective. The selection of the Montfort area as the intermediate substation location significantly impacted the selection of the study area for the Project. The Applicants removed the areas that included Darlington and Spring Green as being too distant from Montfort. A route through Spring Green was also dismissed because it required two crossings the Wisconsin River and siting within the Lower Wisconsin State Riverway in order to follow existing transmission lines and/or USH 14. The Applicants also heard repeated public and stakeholder groups state a preference for avoiding areas of cultural importance, such as the House on the Rock, the American Players Theatre and the Frank Lloyd Wright property Taliesen, which are located directly south of USH 14.

As a result, the study area excluded the northwestern portion of Iowa County and encompassed more than 1,100 square miles between southwestern Grant County and northern Dane County as is shown in **Appendix A, Figure 2**.

Mississippi River Crossing

To connect the designated end points for the Project, the route must cross the Mississippi River. The Applicants analyzed possible river crossings along more than 46 river miles of the Mississippi River, an area that extended south of Dubuque, Iowa, and north of Cassville, Wisconsin, including a possible river crossing at Guttenberg, Iowa.

After evaluating various river crossing locations, conducting an extensive Alternative Crossings Analysis and Macro-Corridor Study as part of the federal review of the Project, and following consultation and feedback from applicable state and federal entities with permitting authority, the Applicants determined that crossing the Mississippi River near Cassville was the only feasible option. This determination removed the Dubuque and Guttenberg areas from consideration and reduced the federal study area accordingly.

The Applicants then concluded that the two overhead alternative crossing locations at Nelson Dewey and Stoneman are technically and economically feasible and should be reviewed by the USFWS for compatibility and permitability. For both of these crossing location alternatives, the Applicants propose to lessen the Project's footprint in the Refuge by reconfiguring and co-locating with Dairyland's existing 161 kV line crossing the Mississippi River at the Stoneman crossing. The existing 69 kV line crossing the river would be eliminated by making modifications to the Dairyland transmission system in Iowa. If the Nelson Dewey crossing is selected, the existing crossing at Stoneman would be eliminated, allowing the existing 69 kV and 161 kV ROW within the Refuge to be returned to their natural condition.

The Applicants prefer the Nelson Dewey crossing location over the Stoneman location since the Nelson Dewey alternative crossing location presents fewer overall constraints to Project engineering and would result in fewer overall potential environmental and societal impacts. Specifically, the Nelson Dewey crossing location:

- Has a shorter linear distance across the Refuge and would require less transmission line ROW within the Refuge (approximately 22 acres of ROW compared to 46 acres at Stoneman). Use of the Nelson Dewey crossing location would also include fewer acres of freshwater emergent wetlands, forested/shrub wetlands, and woodlands within the route ROW compared to the Stoneman crossing location.
- Provides the opportunity to relocate the existing 161 kV transmission line from the Stoneman crossing to co-locate with the 345 kV line at Nelson Dewey. The existing 69 kV line at Stoneman would be removed. This will allow for natural revegetation (in consultation with USFWS) of the existing 161 kV and 69 kV transmission corridors.
- Has existing associated transmission line ROW that extends through undeveloped portions of Cassville, Wisconsin, and east toward the remaining Project termination points in Wisconsin. In other words, the Nelson Dewey crossing location ties directly into existing 138 kV corridors that extend to the Project's proposed intermediate substation location. Existing transmission line corridors are the highest-ranked priority corridor for transmission line siting under Wisconsin's Siting Priorities law.
- Has no residences, schools, daycares, places of worship, airports, or businesses in the immediate proximity. The Stoneman crossing location includes all of these constraints, including the presence of the Cassville Municipal Airport (with the runway located approximately 2,000 feet from the crossing location). Due to the airport and the height of the bluff immediately east of Cassville, transmission line structures located in the airport's conical surface would likely require additional evaluation and design and may need to be limited in height.
- Is farther away from known areas that support resting and feeding habitat for migratory avian species, including Dead Lake and the Wood Duck Slough.

<u>Proposed Hill Valley Substation Site</u>

The Applicants determined that an intermediate substation in the Montfort, Wisconsin, area was the most appropriate from an electrical and routing and siting perspective (see Planning Analysis provided in **Appendix D, Exhibit 1**). The Applicants studied numerous properties in a radius around the village of Montfort to identify suitable parcels of land for a substation. Properties included the Eden Substation in the town of Eden as well as greenfield properties of sufficient size to accommodate the substation. In addition to size, criteria evaluated to determine a suitable intermediate substation location, included the proximity to existing transmission lines and potential new route options, topography, environmental impacts, current land use, neighboring land use, and properties listed for sale.

The Eden Substation site, see **Appendix A, Figures 3, page 33 and Figure 4, page 49**, was determined to be unsuitable for expansion and addition of 345 kV substation facilities because of constraints present at and around the substation property. The existing property, owned by

Wisconsin Power and Light, is not large enough to accommodate the new 345 kV assets and is encumbered by an existing communication tower. If the existing Eden Substation site were to be used, additional land would have to be procured, which is constrained to the west by adjacent residential developments, to the north by a public trail, and to the east by existing commercial development. This location and the neighboring land use constraints would also have routing and siting limitations for current and potential future transmission lines. Due to these constraints, the Applicants evaluated other substation locations.

The Applicants proceeded to identify other suitable sites in the Montfort area. During the public participation process, the Applicants learned about a property in the Montfort area the individual was interested in selling. This property was determined to be suitable for the substation and was selected for evaluation as a potential substation site. An existing ATC 138 kV transmission line crosses this site, minimizing new ROW required to route the proposed transmission line in and out of the substation, thereby reducing overall impacts. ATC purchased this site in January 2018. This site is the Proposed Substation site for the intermediate substation, to be named Hill Valley. The site is shown in **Appendix A, Figure 3, page 32 and Figure 4, Page 48.**

The Other Substation Site identified in this application, shown in **Appendix A, Figure 3, page 32 and Figure 4, page 48**, has similar characteristics to the ATC-owned site. Additional new ROW to route the proposed transmission line and the existing 138 kV transmission line in and out of this substation site would be required, creating new impacts to landowners not previously impacted by the existing transmission lines in the area. Additionally, an existing double-circuit 69 kV transmission line would need to be crossed when accessing the Other Substation Site from the south and west. Line crossings are avoided where possible in order to minimize potential reliability concerns. Because of the additional landowner impacts and potential reliability concerns, and the availability for purchase of the proposed substation site, the Other Substation Site was rejected by the Applicants. The RUS chose to carry this site forward in the federal Environmental Impact Statement being prepared for the Project to present an alternative to the proposed site. It is included here to maintain coordination with the federal process being undertaken to support the applicants and the Mississippi River crossing.

Identifying Preliminary Route Corridors

Applicants began their route development process by identifying existing linear features such as transmission lines, other utilities, highways, and railroads consistent with the siting priorities established in Wis. Stat. § 1.12(6). The Applicants then evaluated preliminary corridors that ranged from 1,000 feet to 1-mile wide including areas of new ROW to connect existing linear features. Balancing a number of factors, including environmental impacts, constructability, and public input, these corridors were revised and then narrowed to 300-foot-wide preliminary routes.

The revision of the corridors included the Applicants evaluating corridors following an existing 138 kV line in a northeastern direction and then USH 14 west past Cross Plains and continuing past Black Earth, Mazomanie, and Arena. These corridors were eliminated because they would have required lengthy bypasses off the highway around each municipality due to population density, and would have resulted in a route further away from the Substation siting area near Montfort.

The 300-foot wide preliminary routes were identified in Wisconsin in support of the NEPA review being conducted by RUS. As part of the NEPA process, preliminary routes were revised to include some additional or expanded corridors and removing others from consideration. Through further data collection, analysis and review, the preliminary corridors were narrowed to 150-feet wide preliminary routes in Wisconsin for most areas.

Proposed Routes

Based on the considerations discussed above, the Applicants identified two routes, as shown in Appendix A, Figure 1, designated Preferred and Alternate from the Mississippi River near Cassville, to the intermediate substation, to be known as Hill Valley, near Montfort, and from the intermediate substation to the Cardinal Substation in the Town of Middleton. The routes and associated route segments are identified in more detail on the maps contained in **Appendix A, Figures 3 and 4**.

The two routes proposed in this Application are superior to all other route variations evaluated by the Applicants. Between the Preferred and Alternate Routes, the Applicants selected Preferred Route as the best route for the Project because the Preferred Route is shorter (87.5 miles compared to 102.3 miles; shares more existing utility and transportation corridor by length, 95% to 63%; and shares more existing infrastructure right-of-way by area when compared to the Alternate Route, 42% to 26%. With the Preferred Route sharing more higher priority corridors (as defined in Wis. Stat. § 1.12(6)) and being shorter than the Alternate Route, there are less environmental impacts, including less new ROW area in agricultural and undeveloped lands.

Other Route Segments

Appendix A, Figures 3C and 4C, and the impact tables in **Appendix B** also identify route segments and a substation site designated as “Other.” These Other Route Segments and the Other Substation Site were selected to carry forward in the federal Environmental Impact Statement being prepared for the Project. The Applicants are including, but not recommending these route segments and substation site due to the routing considerations discussed above, including that the “Other” routes generally follow lower-priority route corridors and have more impacts than the proposed Preferred and Alternate Route segments.

The Other Routes Segments and the Other substation site are included in this Application to maintain coordination with the federal process being undertaken to support the Applicants and the Mississippi River crossing.

5.2 Changes to Existing Easements

The Applicants intend to acquire new high-voltage easements for this Project for both new ROW and where the Project ROW overlaps existing transmission line ROW. In those locations where Project ROW overlaps an existing transmission line easement owned by ATC or Dairyland, the Applicants will evaluate whether the existing easement will be retained or released at the conclusion of all construction activities. ATC and Dairyland generally intend to release the existing easements, but may retain an existing easement based on the specific provisions in the easement and the needs of the Project. For instance, there may be a need to retain an existing easement due to property usage restrictions recorded after the existing transmission line easement.

5.3 Route Segments

The following route segment descriptions reference the typical structure drawings found in **Appendix C, Figures 1 through 12**. Variations of these structure configurations could be used on the Project based on site-specific requirements such as, but not limited to, line angle, ROW width restrictions, and clearance limitations.

Mississippi River Crossing to Hill Valley Substation

Between the Mississippi River crossing at the Nelson Dewey location and the Hill Valley Substation, the Applicants propose two route options made up of the following segments and sub-segments:

	County(ies)	Segments (Common segments are listed in **bold**)
Preferred Route	Grant	**A01A**, A01B, A02, A03, D01, D03, D03, D04, D05, D08, D09A, **D10A, D10B*, L05**
Alternate Route	Grant, Iowa, and Lafayette	**A01A**, C02A, C02B, C04, E01, E03, E04, E06, E07, E09, E10, E12, E13, E14, E16, E18, 19, G01, F01, F02, F03, G06A, G06B, G08, G09, H01, H02, H03, H06, H07, H09, I01, I02, I05, I06, I07, I08, I09, K01, L01, L02, L03, L04, **L05** and **D10A, D10B,** D10C*

* Segments D10A, D10B and D10C are used for routing the 138 kV line X-16 to the Hill Valley Substation.

Preferred Route

Segments A01, A02: The proposed 345 kV line would cross the Mississippi River using the Nelson Dewey crossing location near the Nelson Dewey Substation northwest of the village of Cassville in a double-circuit configuration with the Dairyland 161 kV line that presently terminates at the Stoneman Substation (**Appendix C, Figure 1**). After crossing the Mississippi River to the south of the Nelson Dewey Substation, the proposed 345 kV line would extend north/northwest along the southwestern boundary of the Nelson Dewey Substation. The 161 kV line would be terminated at the Nelson Dewey Substation. The proposed 345 kV line would then turn and extend along the northwest boundary of the Nelson Dewey Substation as a single-circuit line (**Appendix C, Figure 2**) before angling east to parallel the existing X-15/X-16 transmission lines to the northeast up the bluff after crossing County Highway (CTH) VV.

Segments A03, D01, D03: At the top of the bluff, line X-15 extends east while line X-16 continues generally northeast. The new 345 kV line would be constructed as a double-circuit line with the X-16 line (**Appendix C, Figure 3**), generally offset to the north of the existing 138 kV centerline by 75 feet for constructability. Northwest of the intersection of STH 81 and Settlement Road, the double-circuit 345 kV/X-16 line would transition to an alignment south of the existing X-16 line to avoid several structures, and continue to parallel the existing alignment northeast until east of Hauger Lane, where it would transition back to the north side of the X-16 line.

Segment D04: The 345 kV/X-16 double-circuit line would continue to parallel on the north side of the existing X-16 alignment, crossing STH 81, Rattlesnake Road, County Highway CTH U, Blackjack Road, Grant River Road, Five Points Road, Bee Lane, CTH N, Boice Creek Road, and Old Potosi Road, before transitioning to the south of the line X-16 to minimize impact to a home located near the line and USH 61. East of USH 61, the line would transition back to the north of the X-16 alignment west of STH 129.

Segment D05: At STH 129, the X-16 line cuts into the Lancaster Substation, while the new proposed 345 kV line would extend northeast as a single-circuit line and cross STH 129 north of the Lancaster Substation. The new 345 kV line then would extend northeast around the Lancaster Substation before re-joining with line X-16 as a double-circuit line.

Segments D08, D09A: The proposed 345 kV line would re-join with line X-16 again to parallel the X-16 alignment as a double-circuit line to the north. The 345 kV/X-16 double-circuit line would then continue to parallel the existing alignment of line X-16, crossing over Muldoon Lane, Lincoln Road, Orfield Lane, CTH A, Coon Hollow Road, Ridge Road, Sleepy Hollow Road, Scenic Road, Pine Knob Road, West CTH E, Hopewell Road, and Rock Church Road. At Laplatte Road, the double-circuit line would cross to the south side of the existing X-16 alignment to maintain required clearance to a barn adjacent to the ROW. The new line would then parallel the existing alignment of line X-16 to the northeast to the Hill Valley Substation, crossing Ebenezer and Stockyard roads.

Segment L05: The 345 kV line would then turn north as a single-circuit line before terminating at the Hill Valley Substation.

Segments D10A, D10B: Line X-16 would then head east as a single-circuit line (**Appendix C, Figure 14**) for one span before turning north and terminating at the Hill Valley Substation.

Alternate Route

Segments A01A, C02A: The proposed 345 kV line would cross the Mississippi River near the Nelson Dewey Substation northwest of the village of Cassville in a double-circuit configuration with the Dairyland 161 kV line that presently terminates at the Stoneman Substation (**Appendix C, Figure 1**) [NN0DNHSS]. After crossing the Mississippi River to the south of the Nelson Dewey Substation, the proposed 345 kV line would continue along the southeast side of the Nelson Dewey Substation. The existing Turkey River to Stoneman 161 kV line would terminate at the Nelson Dewey Substation.

Segments C02B, C04, E01, E03, E04, E06, E07, E10: The proposed 345 kV line would parallel the existing Dairyland 161 kV line as a single-circuit line (**Appendix C, Figure 4**) to the top of the bluff, crossing over the lineX-15. After crossing over line X-15, the new 345 kV would turn east and pick up line X-15, extending as a double-circuit line (**Appendix C, Figure 3**) parallel to the current alignment of line X-15, typically offset by approximately 75 feet for constructability. The route would then extend parallel to the current alignment of line X-15, crossing over STH 133/Great River Road, Millstream Lane, Cadwell Road, STH 133/Great River Road, Adrian Hollow Road, and West Haas Road. East of Chaffie Hollow Road the line would then extend south along the current alignment of the X-15 line, crossing to the south side of the existing transmission line alignment. The line would continue parallel to the existing X-15 alignment until east of CTH N, where it crosses back to the north side of the existing alignment and continuing on will cross Dugway Road, Dutch Hollow Road, Reynolds Ridge Road, CTH U, and Old Potosi Road.

Segments E12, E13: At Stage Road, line X-15 ties in to the existing Potosi Substation tap structure. Line X-15 then would rejoin the 345 kV line and continue east.

Segment E14: The line turns southeast, crossing over the existing alignment of line X-15 west of Buena Vista Lane to avoid structures. The line would then continue east over Buena Vista Lane and USH 61, continuing east for approximately 1,400 feet, then turning northeast to cross to the north side of the existing line X-15 alignment.

Segments E16, **E18, E19:** The 345 kV/X-15 double-circuit line would extend east along the north side of the existing alignment of line X-15, crossing Rockville Road, West Road, Big Platte Road, Bennett Lane, Stanton Road, Harrison Road, Morris Road, and Maple Glen Lane, until west of Southwest Road where line X-15 would continue east on the existing X-15 alignment to the Hillman Substation.

Segment G01: The new 345 kV line would then extend south as a single-circuit line (**Appendix C, Figure 4**) to avoid structures along Southwest Road.

Segments F01, F02, F03: The 345 kV line would continue east approximately 1.8 miles, crossing Southwest Road and CTH D, before turning south.

Segments G06A, GO6B: The new 345 kV line would continue south crossing over USH 151 before turning east along College Farm Road, crossing Pleasant Valley Road, and turning northeast to parallel USH 151 and cross to the north side of existing line X-14.

Segments G08, G09: The 345 kV line then would pick up line X-14 and parallel the north side of its existing alignment as a double-circuit line (**Appendix C, Figure 3**)], crossing Ipswitch Road. The line would continue east before turning north as a single-circuit line (**Appendix C, Figure 4**), with line X-14 continuing east on its existing alignment. The 345 kV line would then cross CTH XX and USH 151.

Segment H01: The 345 kV line would continue cross-country heading north until joining with the existing 69 kV line Y-105 at Michell Hollow Road.

Segment H02: The line would then be built as a double-circuit line (**Appendix C, Figure 5**) [NJ0TNT3S] with Y-105 along its current alignment, crossing CTH B, to Sunny Lane.

Segment H03: The double-circuit line would continue west and then north along Sunny Lane to W. Mound Road to avoid structures along the existing route.

Segment H06: The line would then return to the existing alignment of the Y-105 line extending generally north, along Sunnydale Road and CTH G, and crossing Turnbull Road, until south of the village of Rewey.

Segment H07: At the village of Rewey the route would extend west of CTH G, north, then east back to CTH G as a single-circuit line (**Appendix C, Figure 4**). Line Y-105 travels in to Rewey to serve a substation, then returns to the 345 kV line on the north side of the village. The line would then parallel CTH G as a double-circuit line (**Appendix C, Figure 5**) north on the west side of CTH G until Argall Road, where it would cross back to the east side of CTH G to return to the existing alignment of line Y-105.

Segments H09, I01: The line would then follow the existing alignment of the Y-105 line along CTH G until just north of Bollant Road.

Segments I02, I05: The double-circuit line would cross to the west side of the road (now CTH E) for one structure to avoid structures on the east of the side road then return back to the east side of CTH E to the current alignment of line Y-105.

Segments I06, I07: At the intersection of CTH E, Enloe Road, and CTH XX the line would extend from the east side of CTH E to the northwest, crossing to the north side of CTH E after turning west.

Segment I08: The line would then turn and proceed north cross-country to CTH X.

Segment I09: The double-circuit line would turn and extend west back to the current alignment of line Y-105 at STH 80.

Segments K01, L01: The line would then turn and continue north following STH 80 until south of the intersection of STH 80 and Ebenezer Road.

Segments L02, L03, L04: The 345 kV line would continue northwest and then due north as a single-circuit line (**Appendix C, Figure 4**) to the Hill Valley Substation. The Y-105 line would continue north along STH 80 and its existing alignment until it terminates at the Eden Substation.

Segment L05: The 345 kV line would then continue north as a single-circuit line before terminating at the Hill Valley Substation.

Segments D10A, D10B, D10C: Line X-16 would head east as a single-circuit line (**Appendix C, Figure 14**) before turning north and terminating at the Hill Valley Substation.

Hill Valley Substation to Cardinal Substation

Between the new intermediate substation, called Hill Valley and the existing Cardinal Substation, the Applicants propose two route options made up of the following segments and sub-segments:

	County(ies)	Segments (Common segments are listed in bold)
Preferred Route	Grant, Iowa, and Dane	**N01, N03, N04, N05, N06, N07***, Q01, Q01, Q02, Q03, Q04, Q05, Q06, S01, S04, S05, S08, S09, S10A, S10B, S10C, S10D, S12, S13, T01, T02, T03, T04, T05, V01, V02, V03, V04, V05, V06, **W03**, **W04**, **Y01A**, **Y01B**, **Y01C**, **Y05**, **Y06A**, Z02, Z01B, **Y07** and **Y08.**
Alternate Route	Grant, Iowa, and Dane	**N01, N03, N04, N05, N06, N07***, P01, P02, P03, P04, P05, P06, P07, P08, P09, W01, W02, **W03**, **W04, Y01A, Y01B, Y01C, Y05**, **Y06A**, Y06B, **Y07 and Y08**.

***** Segment N07 is used to route to route the 138 kV line X-127 (formerly X-16) to the Eden Substation.

Preferred Route

Segments N01, N03: The proposed 345 kV line and 138 kV transmission line X-127 (formerly X-16) would exit the north side of the substation to stand alone structures. After two spans, line X-127 and the proposed 345 kV line proceed as a double-circuit line (**Appendix C, Figure 6**) following the existing X-16 alignment (typically offset 40 feet for constructability) until it reaches the south side of USH 18.

Segments N04, N05: The new 345 kV line would turn east along the south side of USH 18 for one span where it will then double-circuit (**Appendix C, Figure 7**) with the existing 69 kV line Y-138 on the south side of USH 18.

Segment N07: Line X-127 would continue as a single-circuit (**Appendix C, Figure 13**) line into the Eden Substation following the existing ROW (typically offset 40' for constructability).

Segments N06, Q01, Q02: The line would then continue east along USH 18 as a double-circuit line crossing to the north side of USH 18 near CR XX to the existing Y-138 ROW. The line then proceeds along the Y-138 ROW, which deviates from the USH 18 alignment to the north of the villages of Cobb and Edmund, and crosses to the south of USH 18 at Sinbad Road, and continues to just west of the city of Dodgeville.

Segments Q03, Q04: Line Y-138 would jump off to a standalone switch structure that taps the Lands End Substation. The 345 kV/Y-138 would then continue east on the south side of USH 18 in a double-circuit (**Appendix C, Figure 7**) configuration.

Segments Q05, Q06: At St. Johns Street, line Y-138 would follow its existing alignment to the south. The proposed 345 kV line would then continue to follow USH 18, as a single-circuit line designed for future 138 kV underbuild (**Appendix C, Figure 7**). The proposed line would then cross over USH 18 just west of the USH 18/151 interchange to be on the north side of USH 151.

Segments S01, S04, S05, S08, S09, S10A, S10B, S10C, S10D, S12, S13: The proposed 345 kV line would continue east along USH 151, crossing CTH Y before crossing to the south side of USH 151. The line would then remain on the south side of USH 151 until the interchange just to the east side of the village Mount Horeb, at which point the future 138 kV underbuild design ends. In Segment S10B the line will be located within USH 151 ROW to avoid an adjacent property that is encumbered by a conservation easement.

Segment T01: East of CTH ID, the 345 kV line would cross USH 151 and proceed north, cross country, as a single-circuit line (**Appendix C, Figure 8)** until it meets up with the existing line Y-128 line just south of CTH S and Wally Road near the switch structure for the North East Mount Horeb Municipal Substation.

Segments T02, T03, T04, T05, V01, V02, V03, V04, V05: The proposed 345 kV line would then double-circuit with line Y-128 (**Appendix C, Figure 7**) and generally follow the existing Y-128 alignment (offset where practical for constructability), with slight variations around two farms, until just south of Stagecoach Road where the Y-128 line would jump off and cross over CTH P to its existing alignment at the end of Segment V05 into the Stagecoach Substation.

Segment V06: The proposed 345 kV line would then continue along CTH P as a single-circuit line to the north side of Stagecoach Road.

Segments W03, W04, Y01A, Y01B, Y01C: The proposed 345 kV would turn east, double-circuit with existing 69 kV line 6927 (**Appendix C, Figure 7**). The double-circuit line would follow Stagecoach Road along the line 6927 alignment for about 0.6 miles. Both circuits would then cross to the south side of the road and continue east until meeting up with the railroad and the existing line 6927 alignment. Along Segment Y01A the line will be designed such that ROW is not needed from property north of Stage Coach Road encumbered by a conservation easement.

Segment Y05: From there the lines would follow the existing line 6927 alignment paralleling the railroad until Cleveland Road, at which point line 6927 will connect to a new standalone switch structure (**Appendix C, Figure 9**) near the existing line 6927 switch.

Segments Y06A, Z02: The double-circuit line would then cross to the north side of USH 14 and proceed east following the USH 14 ROW for approximately 0.7 miles before crossing back to the south side of USH14.

Segment Z01B: The double-circuit line would then parallel the railroad tracks on the south side of USH 14 until it meets up with the existing line 6927 alignment.

Segments Y07, Y08: The double-circuit line would then continue east until line 6927 transitions to an existing riser structure where Segment Y08 turns south. Line 6927 would continue underground until it terminates at the West Middleton Substation. The 345 kV line would then be constructed as a single-circuit line designed for future 138 kV underbuild (**Appendix C, Figure 10**) as it heads south for a span. The line would then continue as a single-circuit line (**Appendix C, Figure 11**) east and north into the Cardinal Substation.

Alternate Route

Segments N01, N03: The proposed 345 kV line and 138 kV transmission line X-127 (formerly X-16) would exit the north side of the substation to stand alone structures. After two spans, line X-127 and the proposed 345 kV line proceed as a double-circuit line (**Appendix C, Figure 6**) [CHCTLP-007] following the existing X-16 alignment (typically offset 40 feet for constructability) until it reaches the south side of USH 18.

Segment N07: Line X-127 would continue as a single-circuit line (**Appendix C, Figure 13**) into the Eden Substation following the existing ROW (typically offset 40' for constructability).

Segments N04, N05, N06, P01: The new 345 kV line would proceed in a single-circuit configuration (**Appendix C, Figure 8**) east along USH 18 for two spans and then north for two spans until it intersects with existing line X-17.

Segment P02: The new 345 kV line and line X-17 would then be double-circuit (**Appendix C, Figure 6**) along the existing X-17 alignment (typically offset 40 feet for constructability) for approximately 8.7 miles at which point line X-17 would continue to the northeast.

Segments P03, P04, P05, P06, P07, P08, P09, W01: The 345 kV line would continue as a single-circuit line (**Appendix C, Figure 8**) and travel generally east, cross country until it joins with the existing 69 kV line Y-62 at the intersection of Celestial Circle and Stagecoach Road.

Segment W02: Line Y-62 would then be underbuilt (**Appendix C, Figure 12**) for one span along its existing alignment before terminating at the Stagecoach Substation immediately west of CTH P. The new 345 kV line would then cross CTH P to the north side of Stagecoach Road.

Segments W03, W04, Y01A, Y01B, Y01C: The proposed 345 kV would turn east, double-circuit with existing line 6927 (**Appendix C, Figure 7**). The double-circuit line would follow Stagecoach Road along the existing line 6927 alignment for about 0.6 miles. Both circuits would then cross to the south side of the road and continue east until meeting up with the railroad and the existing line 6927 alignment. Along Segment Y01A the line will be designed such that ROW is not needed from property north of Stage Coach Road encumbered by a conservation easement.

Segment Y05: From there the lines would follow the existing line 6927 alignment paralleling the railroad until Cleveland Road, at which point 6927 will connect to a new standalone switch structure (**Appendix C, Figure 9**) near the existing 6927 switch.

Segments Y06A, Y06B: The double-circuit line (**Appendix C, Figure 7**) would then cross over USH 14 and turn east following the existing line 6927 alignment, crossing back over USH 14 again.

Segments Y07, Y08: The double-circuit line would then continue east until line 6927 transitions to an existing riser structure where Segment Y08 turns south. Line 6927 would continue underground until it terminates at the West Middleton Substation. The 345 kV line would then be constructed as single-circuit line and designed for future 138 kV underbuild (**Appendix C, Figure 10**) as it heads south for a span. The line would then continue as a single-circuit line (**Appendix C, Figure 11**) east and north into the Cardinal Substation.

Other Route Segments

Segment A01C: This segment would provide for an alternative routing of the Preferred Route to the south and east of the Nelson Dewey Substation. This segment was rejected by the Applicants because it would require crossing multiple existing transmission lines, which presents reliability and maintenance concerns.

Segments B01, B02, B03, B04, C01 and C03: These segments would only be used if the existing Mississippi River crossing at Stoneman is selected and permitted by USFWS. The Applicants have stated a preference for a river crossing at Nelson Dewey to minimize the overall impacts in the Upper Mississippi River National Wildlife Refuge.

> **Segment B01**: This is the existing double-circuit 161/69 kV transmission line crossing of the Mississippi River at the Stoneman Power Plant. If this crossing is used, it would become a double-circuit 345 kV/161 kV line crossing. The 69 kV line would be replaced by facilities in Iowa. This would be a common segment if the Mississippi River crossing at Stoneman is used.
>
> **Segment B02**: The proposed 345 kV line would be double-circuit with the Dairyland 161 kV line as it passes west to east through the village of Cassville. This would be a common segment if the Mississippi River crossing at Stoneman is used.
>
> **Segment B03**: The 345 kV line proceeds north and east cross country until it meets Dairyland 69 kV line N-11. This segment would be used for the alternate 345 kV line route.
>
> **Segment B04**: The line then continues double-circuit with 69 kV line N-11 until it joins the alternate 345 kV line route at Segment E01.
>
> **Segments C01, C03**: The 345 kV line proceeds primarily as a double-circuit line with the existing Dairyland line Q-2D until it meets the Preferred Route 345 kV line route at Segment D01.

Segments F04, F06 and G04: These segments provide alternate routing south of the city of Platteville that would allow some corridor sharing with USH 151. This option was rejected by the Applicants due to the increased number of angle structures required. The proposed 345 kV line would proceed southerly, cross country as a single-circuit line to, and then east, along the USH 151 ROW. These segments would replace Segments F02, F03 and G06, of the Alternate Route for the 345 kV line.

Segments J01, J02, J03 and J04: These segments in combination provided for a cross country alternative route around the village of Livingston. The Applicants' Preferred Route utilizes the higher priority existing transmission line ROW to a greater extent. The line would travel west, north, then east as a single-circuit line around the village of Livingston, primarily cross country and following town roads. This option uses less exiting ROW than the proposed route east of the village of Livingston.

Segments D09B, M01 through M05, R01, R02, and O01 through O03: In various combinations these segments allow for alternative routing of the lines in or out of the Hill Valley Substation depending on the substation location and the 345 kV line route chosen. The Applicants selecting and purchasing the Preferred Substation Site eliminated the majority of these segments from the Applicants' consideration.

Segments R03 through R15: The following segments, in combination, provide for an alternative to the Applicants' preferred route between the Hill Valley Substation area to east of the city of Dodgeville. These segments in combination, utilize more new cross country ROW with some existing 69 kV line corridor sharing, compared to the preferred 345 kV line route, which shares ROW with USH 18 and existing 69 kV ROW for a majority of this area.

> **Segment R03**: The line proceeds east, double-circuit with 69 kV line Y-106 on the south side of CTH B, crossing to the north and back to south just west of Anderson Lane to avoid farm buildings. The line then crosses back to the north just west of CTH G, again to avoid farm building near the road.
>
> **Segments R04, R05**: The line leaves the Y-106 alignment and proceeds primarily cross country south and east as a double-circuit line and rejoins the Y-106 alignment at Whitson Road. These segments avoid constraints posed by buildings and a cemetery along Glaeser Road.
>
> **Segment R06**: The line then proceeds double-circuit with Y-106 to STH 39.
>
> **Segments R07, R08, R09**: From STH 39, the line proceeds in easterly as a single-circuit line primarily following roads and some cross-country portions to USH 151.
>
> **Segments R10, R11, R12, R13, R14**: The proposed 345 kV line then follows USH 151, on the north side of the ROW to the USH 151/USH 18 interchange.
>
> **Segment R15**: The line crosses to the south side of USH 151, providing an optional alignment to Segments R11, R13, and R14.

Segments S02 and S03: These segments provide for an optional alignment to Segment S01 on the Preferred Route with no advantage over the proposed alignment.

> **Segment S02**: The proposed line crosses (from Segment R14) to the south side of USH 18, east of the USH 151/USH 189 interchange.
>
> **Segment S03**: The line proceeds east on the south side of USH 18.

Segments S11A through S11D: These segments provides an option to Segment 10 in this area. Properties on both sides of the highway are encumbered by conservation easements in this area. The Applicants determined that Segment 11 presented increased challenges due to extra highway crossings and ROW width restrictions necessary to eliminate impacts on the adjacent encumbered property. The line would proceed as a single-circuit line along USH 151 crossing to the north side of the road on Segment S11A and returning to the south side of USH 152 on either S11C to avoid the Military Ridge State Trail, or Segment S11D. Segment S11B would be located within USH 151 ROW to avoid an adjacent property encumbered by a conservation easement.

Segment U01: This segment provides for an alternative to the Preferred Route east of the village of Dodgeville. The Applicants' Preferred Route along Segment T utilizes existing transmission line ROW to a greater extent. The line proceeds east along USH 18 then leaves the highway to proceed in a northerly direction to the town of Cross Plains.

Segment X01, X02: Combinations of Segment X can be used with the Applicants' Preferred and Alternate routes for alternative routing at Stage Coach Road. The Preferred and Alternate routes use existing transmission line ROW to a greater extent in this area. The line proceeds east as a single-circuit line cross country, approximately a quarter section south of Stage Coach Road.

Segment Z01A: The line proceeds along the south side of USH 14 as a single-circuit line providing an alternative to Segment Z02 on the Preferred Route. This segment was avoided due to construction difficulties presented by the terrain, highway and railroad in this area.

5.3.1 Transmission Structure Type and Dimensions

The structures would be self-supporting tubular steel monopoles, whether as single-circuit or double-circuit, and would have a galvanized or weathering steel finish. Single-circuit tangent and small angles would typically be in a delta configuration, except where there is limited ROW available or clearance limitations, at which point they would be in a vertical configuration. Single-circuit medium angles, large angle, and dead-end structures generally could be either a vertical or delta configuration, depending on ROW or clearance limitations. Double-circuit tangents, angles, and dead-end structures would generally all be in a vertical configuration. Between the Mississippi River crossing location and the Hill Valley Substation, the spans will typically be in the 800 to 1200-foot range for single-circuit and double-circuit sections. Between the Hill Valley and Cardinal substations, the spans would typically be in the 750 to 900 foot for sections with 138 kV underbuild, and 850 to 1100 foot span range for single-circuit and double-circuit back-to-back configurations.

Typical structure heights will range from 120 to 175 feet.

5.3.2 Transmission Line Configuration

Different transmission line configurations are proposed for the locations where the new 345 kV line is double-circuited with an existing lower-voltage line. In some locations the transmission line would have a delta configuration for the new 345 kV line with the lower-voltage circuit located in an underbuilt configuration on the structure. Between the Mississippi River crossing and the Hill Valley Substation, X-14, X-15, and X-16 lines would utilize davit arms at the same elevation as the proposed 345 kV circuit on the double-circuit structure, but would utilize voltage specific insulator lengths, as required. Between the Cardinal and Hill Valley substations, X-16 and X-17 lines would be located at the same elevation on the double-circuit structures as the 345 kV circuit with the same insulator configuration, therefore making a visually uniform structure. Additionally, any locations with limited ROW or clearance limitations would have both the 345 kV line and the lower-voltage line in a vertical configuration on the same side of the structure.

A preliminary geotechnical evaluation (desktop review) was conducted for the Project to assess the soil and geologic conditions that could be encountered. Based on that evaluation there are two prevalent foundation types that are anticipated: (1) reinforced concrete caissons; and (2) direct embedded. The bulk of the structures are anticipated to be supported by reinforced concrete caissons. Once soil borings have been obtained and a complete and thorough geotechnical evaluation has been completed during detailed design, the use of alternative foundation systems, such as micropiles or helical piers, may be evaluated and implemented if there are locations with access difficulties and restrictions.

In general, the excavated holes for direct-embedded structures will range from 3 to 6 feet in diameter and 20 to 30 feet in depth, depending on soil conditions. The integrity of the hole may be protected with the installation of a permanent culvert or the use of a temporary casing during construction only. The excavated holes for reinforced concrete caissons will range from 5 to 14 feet in diameter and 20 to 60 feet in depth, depending on soil conditions. If poor soil conditions exist, greater diameters and depths may be required.

When constructing direct-embedded foundations, the required hole is excavated and the embedded portion of the steel structure is inserted into the hole. The structure is plumbed and a granular engineered backfill or concrete is placed around the outside of the embedded portion of the structure and compacted in lifts until the ground surface is reached.

When constructing concrete caisson foundations, the required hole is excavated, concrete caissons are formed using a rebar and anchor bolt cage that is placed into the excavation, and concrete is poured to cover it. The caisson is allowed to cure to develop the necessary strength. After the caisson is cured, the structure is mounted on the caisson using the exposed anchor bolts.

5.3.3 Conductor and Shield wire

The Project's transmission line will be designed for and energized at 345 kV. The Applicants propose the use of a bundled pair of TP-477 kcmil 24/7 ACSR (Hawk) conductors for each phase of the 345 kV circuit. Where existing lower voltages are being rebuilt as part of the Project, a single TP-477 kcmil 24/7 ACSR (Hawk) conductor or a single 477 kcmil Type 13 ACSR (Flicker/Oval) conductor or a conductor of similar capacity will be used per phase.

The transmission line will typically use two shield wires to help protect the phase conductors from lightning strikes. Depending on the line configuration, the two shield wires may consist of one standard steel stranded wire and one steel and aluminum stranded wire containing a fiber optic bundle core (generally known as optical ground wire or OPGW) or two OPGWs. OPGW allows both lightning protection and a communication path between substations.

For the proposed line from the Mississippi River crossing to the Hill Valley Substation, the conductors will be supported by polymer insulators in a V-string or I-string configuration. For the proposed 345 kV line between the Hill Valley and Cardinal substations, the conductors will be supported by glass or porcelain insulators in a V-string configuration. In locations where the proposed 345 kV circuit will be double-circuited with an existing lower voltage line, a mixture of glass or polymer V-string assemblies, I-string assemblies, or polymer braced post assemblies will be used for the lower voltage circuit depending on if the lower voltage circuit is located at the same elevation or in an underbuilt configuration.

5.3.4 Existing Transmission Line Impacts

Several existing 138 kV and 69 kV transmission lines are along the proposed route segments and would require removal and rebuilding as part of the Project. Tables 5.3.4-1 through 5.3.4-3 below summarize the co-located transmission lines by route segment.

Table 5.3.4-1 – Existing transmission lines co-located with the Preferred Route

Segment(s)	Line	Voltage	Owner	Length(miles)
A03, D01, D03, D04, D08, D09A, N01, N03	X-16	138 kV	ATC	34.0
N05, Q01, Q02, Q03, Q04	Y-138	69 kV	ATC	15.6
S13	Y-136	69 kV	ATC	0.1
T02-T05, V01-V04	Y-128	69 kV	ATC	7.3
W03, W04, Y01A, Y01B, Y01C, Y05, Y06A, Y07, Y08, Z01B, Z02	6927	69 kV	ATC	4.1
			Total Length	**61.0**

Table 5.3.4-2 – Existing transmission lines co-located with the Alternate Route

Segment(s)	Line	Voltage	Owner	Length(miles)
C02B, C04, E01, E03, E04, E06, E07, E09, E10, E13, E14, E16, E18, E19	X-15	138 kV	ATC	23.9
N01, N03	X-16	138 kV	ATC	0.9
P02	X-17	138 kV	ATC	8.7
W02	Y-62	69 kV	ATC	0.2
H02, H03, H06, H07, H09, I01, I02, I05, I06, I07, I08, I09, K01, L01	Y-105	69 kV	ATC	15.8
W03, W04, Y01A, Y01B, Y01C, Y05, Y06A, Y06B, Y07, Y08	6927	69 kV	ATC	4.1
			Total Length	**57.7**

Table 5.3.4-3 – Existing transmission lines co-located with the Other Route Segments

Segment(s)	Line	Voltage	Owner	Length(miles)
R03 – R06	Y-106	69kV	ATC	8.5
Z01A	6927	69kV	ATC	0.8
			Total Length	9.3

5.3.5 Existing Distribution Line Impacts

Several existing distribution lines are along the proposed route segments and will require removal and relocation as part of the Project. Tables 5.3.5-1, 5.3.5-2, and 5.3.5-3 below summarize the affected distribution lines by route segment. If the Preferred Route is ordered, approximately 14 miles of distribution lines would need to be removed and relocated. If the Alternate Route is ordered, approximately 14 miles of distribution lines would need to be removed and relocated.

Table 5.3.5-1 – Impacted Distribution Lines – Preferred Route

Segment(s)	Location	Approx. Length (miles)	Owner
Q02	Along north side of USH 18	3.0	Alliant
Q02	Along north side of USH 18	2.1	Alliant
Q02	Along west side of Sinbad Road	0.6	Alliant
Q02	Along south side of USH 18	5.5	Alliant
Q04	Along south side of USH 18 in Dodgeville	0.2	Alliant
S01	Along north side of USHs 18/151	0.3	Alliant
S04	Along south side of USHs 18/151	0.2	Alliant
T2	Along east side of Witte Road and west of Wally Rd	0.4	Alliant
T05, V02	Along south side of CTH J	0.6	Alliant
V04	Along west side of CTH P	0.2	MG&E
V06	Along east side of CTH P	0.2	MG&E
W03	Along north side of Stagecoach Road	0.7	MG&E

Table 5.3.5-2 – Impacted Distribution Lines – Alternate Route

Segment(s)	Location	Approx. Length (miles)	Owner
H02	Along south side of CTH B	0.3	Alliant
H06	Along east side of Sunnydale Road	1.0	Alliant
H006, H9	Along east side of CTH G	3.2	Alliant
H09, I001, I02, I05	Along east side of CTH E	2.0	Alliant
I06, I07	Along north side of CTH E	0.5	Alliant
K01, L01	Along east side of STH 80	2.2	Alliant
P03	Cross country along north side of CTH Q	0.3	Alliant
P04	Along south side of CTH M	0.4	Alliant
P05	Along north side of James Road	0.2	Alliant
P06	Along south side of CTH ZZ	0.7	Alliant
P09	Along east side of CTH Z	0.2	Alliant
P09	Along south side of CTH T	1.4	Alliant
P09	Along east side of CTH K	0.2	Alliant
W01	Along north side of Stagecoach Road	0.2	MG&E
W03	Along north side of Stagecoach Road	0.6	MG&E

Table 5.3.5-3 – Impacted Distribution Lines – Other Route Segments

Segment(s)	Location	Approx. Length (miles)	Owner
U01	Along north side of HWY 18/151	0.2	Alliant
S011	Along north side of HWY 18/151	1.4	Alliant
S03	Along south side of HWY 18/151	0.3	Alliant
R11	Along west side of Simpson Road	0.2	Alliant
R09	Along north side of CTH B	0.8	Alliant
R09	Along northwest side of CTH B	0.8	Alliant
R09	Along south side of CTH B	0.3	Alliant
R09	Along west side of CTH Q	0.3	Alliant
R09	Along north side of CTH B	0.2	Alliant
R06	Along south side of Whitson Road	1.0	Alliant
R04	Along east side of CTH J	0.2	Alliant
R03	Along north side of CTH B	1.0	Alliant
R03	Along south side of CTH B	1.2	Alliant
R03	Along south side of CTH B	1.4	Alliant
R03	Along south side of CTH B	0.9	Alliant
R03	Along south side of CTH B	0.5	Alliant
L03	Along south side of Ebenezer Road	0.5	Alliant

5.3.6 Shared ROW Configuration

As described in **Section 5.3.1**, the Applicants' routing and siting process prioritized the use of existing utility and transportation corridors. When siting structures on route segments following roads and highways, the Applicants typically locate structures a minimum of six feet onto private property where possible. In addition, the conductors (at rest) were designed to be at least 75 feet away from any bridge decks on or crossing a WisDOT regulated roadway to comply with WisDOT requirements. Exceptions are noted in the Segment descriptions in **Section 5.3**.

5.4 Impact Tables

The following tables are included in **Appendix B**.

Table 1 – General Route Impacts

Table 2 – Land Cover

Table 3 – Federal, State, Local, and Tribal Lands Excluding Road ROWs

Table 4 – Distances of Schools, Daycare Centers, and Hospitals from ROW Centerline

Table 5 – Distances of Residential Buildings from ROW Centerline

Table 7 – Route Impact Summaries

Table 8 – Preliminary Off ROW Access

The information contained within **Appendix B, Tables 1 through 5, Table 7 and Table 8** was developed based on a combination of sources including available reference data, aerial photography, and field observations along accessible segments. These sources were utilized to measure and calculate impacts using GIS software.

The reference data utilized include county tax parcel data obtained in spring 2017, databases from the State of Wisconsin regarding the locations of schools, daycares, and hospitals; and state-managed lands information from the WDNR. Two sources of aerial photography were utilized including 2015 National Agriculture Imagery Program (NAIP) photography and Applicant purchased aerial photos taken from flights along the corridors in 2016. The aerial photos taken from flights were viewed in Pictometry, a proprietary imagery-based system that provides high resolution, 2- or 4-way oblique views of the ground surface.

Field observation of the routes include both windshield surveys and field surveys completed along existing ROW completed in May-July 2017. Fieldwork on existing ROW included wetland delineations and direct land cover observations. Where the corridor for analysis extended beyond existing transmission line ROW or other public ROW, adjacent areas were field checked to the extent possible from the existing ROWs.

The below text provides a summary of each table's information for the Preferred and Alternate Routes. Please see the tables for the impacts of each Other Route Segment.

Table 1 – General Route Impacts

The general ROW requirement and ROW sharing characteristics for the Project are presented in **Appendix B, Table 1**. For this table, some route segments are broken into sub-segments to facilitate analysis based on type and extent of existing ROW sharing. GIS software was used to determine sub-segment lengths and shared ROW width.

The type and extent of existing ROW was determined from the following sources in conjunction with aerial photography and field observations:

- Road/Railroad: County parcel data for most of the Project area. In a few areas, parcel data did not define the extent of WisDOT ROW. In those areas, the WisDOT ROW width was estimated based on aerial photograph interpretation (e.g., fence line, differences in vegetation) and immediately adjacent parcel data.

- Transmission line: Typical existing easement widths were obtained from the utility owner, a sample review of representative easements, and/or aerial photo review.
- Distribution line: When a distribution line occurred along a road, it was assumed that the distribution ROW is contained within the road ROW.

The total ROW width for each sub-segment is assumed to be 150 feet in Wisconsin, with the exception of Segments N07, S10B, S11B, Y01A, Y01B, and a few segments for only the 138 kV transmission line (Segments N07 and D10C), which were adjusted to avoid ROW impacts to adjacent properties encumbered by conservation easements. Due to the curvilinear nature of most roads and railroads in the Project area, an average ROW width was calculated for each sub-segment along these corridors.

The Preferred Route from the Mississippi River crossing to the Hill Valley Substation is approximately 34 miles long. It shares approximately 99% of its length and 34% of its area with existing transmission line ROW or road ROW. From the Hill Valley Substation to the Cardinal Substation, the Preferred Route is approximately 53 miles long. It shares approximately 93% of its length and 47% of its area with existing transmission line ROW, road ROW and/or railroad ROW.

The Alternate Route from the Mississippi River crossing to the Hill Valley Substation is approximately 52 miles long. It shares approximately 90% of its length and 47% of its area with existing transmission line ROW and/or road ROW. From the Hill Valley Substation to the Cardinal Substation, the Alternate Route is approximately 50 miles long. It shares approximately 30% of its length and 18% of its area with existing transmission line ROW, road ROW and/or railroad ROW.

Table 2 – Land Cover
Land cover for each segment was identified using aerial photography and field observations in accessible locations. Land cover was digitized into a GIS layer to quantify land cover impacts, and the land cover categories correspond to the categories specified in **Appendix B, Table 2**.

The acreages of each land cover type were quantified within the Project ROW and existing ROW corridors. The resulting acreages are summarized by land cover category for each segment. The most common land cover types within the ROW are crop land and grassland for the Preferred Route and crop land, upland woodland, and grassland for the Alternate Route. **Appendix B, Table 2** provides an estimate of the land cover area that will be impacted by each segment.

Table 3 – Public (Federal, State, Local and Tribal) Lands Excluding ROWs
County parcel data obtained in spring 2017 was used to identify federal, state, local, and tribal lands along the Project ROW. Road ROW was not included in this evaluation. State managed lands were identified from the WDNR's Managed Land's website (http://dnrmaps.wi.gov/DNRManagedLands/).

No tribal lands, , or federally owned lands are present along the proposed Project ROW in Wisconsin. In Iowa, the Project crosses the Upper Mississippi River National Wildlife and Fish Refuge.

The Preferred Route crosses the Black Earth Creek Wildlife Area, the Military Ridge State Trail, University of Wisconsin Observatory, and various village and town parcels.

The Alternate Route crosses the Black Earth Creek Wildlife Area, Blackhawk Lake Recreation Area and associated lands, state Board of Regents agricultural fields, the Pecatonica State Trail, a parcel adjacent to the Belmont Prairie State Natural Area, and village owned parcels.

Table 4 – Distances of Schools, Daycare Centers and Hospitals from ROW Centerline

The presence of sensitive receptors (schools, daycare centers, nursing homes, and hospitals) within 300 feet of the Project centerline were determined using GIS measurements on aerial photography. In addition, the following databases were used to identify these facilities:

- Locations of licensed family and group child care centers were obtained from the Wisconsin Department of Children and Families website (http://childcarefinder.wisconsin.gov) on 8/14/2017;
- Public and private school locations were obtained from the Wisconsin Department of Public Instruction website (http://dpi.wi.gov/gis/school-district-boundaries/data) on 8/14/2017, current as of 2014;
- Home health services, nursing homes, hospitals, and federally qualified health center locations were obtained from U.S. Department of Human Services data provided through Esri ArcGIS Online (http://www.arcgis.com) current as of 4/3/2014; and
- Hospital locations were also verified using data from the U.S. Geographic Names Information System provided through Esri ArcGIS Online (http://www.arcgis.com) current as of 4/13/2017.

The building type was also field verified to the extent possible from existing ROW.

There are no schools, daycare centers or hospitals within 300 feet of either the Preferred or Alternate routes. There are two schools (Cassville High School and Cassville Elementary School) located within 300 feet of Segment B (an Other Route Segment) and one assisted living facility within 300 feet of Segment F (an Other Route Segment). This information is provided in **Appendix B, Table 4**.

Table 5 – Distances of Residential Buildings from ROW Centerline
The type of residential buildings (homes and apartments) and the distance of these buildings from the route centerlines were determined using GIS measurements on aerial photography. The building type was also field verified to the extent possible from existing ROW. This

information is provided in **Appendix B, Table 5**. Residential buildings were tallied according to five distance categories from the ROW centerline: 0–25 feet, 26–50 feet, 51–100 feet, 101–150 feet, and 151–300 feet.

There are 14 homes within 300 feet of the Preferred Route centerline between the Mississippi River crossing and the Hill Valley Substation. There are 101 homes and 8 apartment buildings within 300 feet of the Preferred Route centerline between the Hill Valley Substation and the Cardinal Substation.

There are 39 homes within 300 feet of the Alternate Route centerline between the Mississippi River crossing and the Hill Valley Substation. There are 30 homes within 300 feet of the Alternate Route centerline between the Hill Valley Substation and Cardinal Substation.

Table 7 – Route Impact Summary
Appendix B, Table 7 presents a summary of impacts along the Project routes including total route length and ROW acreage; upland and wetland acreage within the Project ROW; and residential buildings within 300 feet of the route centerline. No new analyses were performed; the data is a summary of the information in **Appendix B, Tables 1-5**.

Because the Other Route Segments do not offer a complete route for the Project, no summary is provided for the Other Route Segments.

5.5 Construction Impacts

5.5.1 Construction Sequence

Construction of an overhead transmission line requires several different activities at any given location. **Section 5.5.2** generally describes the major construction activities and approximate sequence, along with the anticipated impacts associated with each activity.

5.5.2 Construction Impacts by Phase

During construction of an overhead transmission line, several different work functions happen concurrently at any given location. The following information generally describes the major construction activities, their approximate sequence, typical construction machinery used, and the anticipated impacts associated with each activity:

Erosion Control - Installation of erosion control Best Management Practices (BMPs) are location specific and implemented prior to anticipated ground disturbance. Where unexpected ground disturbance occurs, BMPs are installed prior to or immediately after the disturbance occurs. Typical erosion control equipment includes ATVs and trucks for crew transportation, as well as skid loaders, tractors, backhoes, hydro-seeders, and other light-duty equipment.

Surveying and Staking – Surveying and staking will be used throughout multiple phases of the Project. Some examples will be surveying and staking for locating and marking the ROW, environmental sensitivity boundaries, foundations or structure locations, property or section lines, underground and above ground utilities, etc. Surveying and staking will be performed prior to and sometimes after construction activities such as constructability reviews, soil borings, laydown yards, clearing, foundations and hole excavations. These activities have very limited impact on the environment or landowners and are generally completed by a two-person crew travelling by foot, ATV, or pick-up truck.

Soil borings – Collection of geotechnical data will be necessary for final design of the transmission line. Soil borings are generally completed using rubber tired or tracked drill rigs, depending on site and access conditions. A pick-up truck or ATV transports the crew and drilling supplies to the work area. Incidental matting and restoration may be needed. Soil borings will be performed prior to construction activities.

Mobilization and Preparation of Laydown Yards - Initially, labor and equipment will be mobilized to prepare laydown yards for temporary trailer(s) and security measures to receive materials, storage containers, portable toilets, dumpsters, construction mats, tools and equipment, etc. Activities involved to prepare the laydown yards include installation of erosion control measures, any leveling of uneven surfaces, stripping and stockpiling of topsoil (if necessary), and installation of gravel, tracking pads near entry/exit, if needed, installation of culvert(s), power and fencing. This work is generally completed using equipment such as a bulldozer and dump trucks. The disturbance from the laydown yard is dependent on soil type and topography. Depending on landowner preferences, laydown yards may be left in place or returned to prior conditions following construction activities.

Clearing of ROW – To facilitate construction equipment access and ensure safe clearances between vegetation and the transmission line, all vegetation will be cleared for the full width of the ROW. Vegetation will be cut at or slightly above the ground surface using mechanized mowers, sky trims, processors, harvesters, or by hand. Rootstocks will generally be left in place, except in areas where stump removal is necessary to facilitate the movement of construction vehicles, or when reasonably requested by the landowner. Side trimming the ROW would happen shortly after the clearing is completed. Following the side trimming, a final mowing of debris and stump cleanup will be completed. Where permission of the landowner has been obtained, stumps of tall-growing species will be treated with an herbicide to discourage re-growth.

Road Building – In areas of steep topography, access roads and work platforms will need to be constructed prior to construction access. This work is generally completed using equipment such as a bulldozer, track-hoe, skid-loader, and dump trucks. The travel surface of the access road is generally 14-20 feet wide and work platforms are generally 30 feet by 30 feet. The total amount of disturbance of the road (cut slope to base of the spoils slope) is dependent on soil type and topography. Depending on landowner preferences, access roads may be left in place or returned to prior conditions following construction.

Construction Matting – Matting will be installed to provide access through wetlands or other unstable soil areas prior to construction. In addition, permitted temporary clear span bridges (TCSBs) will be installed over waterways. Construction matting may consist of timber, composite, or hybrid timber mats, and will be installed with rubber tired grapple trucks, forwarders, forklifts, or skid loaders. Mat access roads will generally be 16 to 20 feet wide, and mat work platforms may be as large as 100 feet by 100 feet, depending on the type of structure. Wire stringing areas or wire pulling areas are approximately 40 feet by 300 feet. At a minimum, at each wire pulling area, matting will be placed under wire equipment for construction grounding purposes. If a wire stringing location is in a wetland, additional matting will be needed to provide a stable area for the stringing equipment. Incidental matting will also be required at most road crossings. Matting will be removed by similar equipment used for installation as each wire pull or construction segment is completed. During mat placement, use, and removal, standard procedures will be implemented to prevent or minimize the spread of invasive species.

Temporary Material Staging – Besides storing materials at the laydown yards, there will be temporary staging of materials such as structures and hardware along the ROW prior to construction installation. This work involves such equipment as semi-trucks, loaders, and cranes to unload structures and other materials near each work location.

Foundation Installation and/or Excavation - In general, the excavated holes for each type of foundation will range from five to 14 feet in diameter and 20 to 60 feet in depth, or greater, depending on soil conditions. The method of installation, diameter and depth of the foundation will vary depending on the soil capability and structure loadings. Excavation is required for all structures whether they are direct-embedded or use reinforced concrete foundations.

In areas where groundwater seeps into the excavation, or where water is needed to hold the hole during drilling, it may be necessary to dewater the excavation. Depending on site conditions, the water may be de-silted and discharged to an upland area where it is allowed to re-infiltrate, or removed from the site via a tank truck. Dewatering will proceed in accordance with applicable regulations and permit requirements.

For direct-embedded poles, a hole will be excavated to the appropriate depth. The base of the structure will be placed into the excavated hole or, if soils are unstable, into a culvert, the area around the pole will be backfilled with clean granular fill or concrete.

For structures requiring a reinforced concrete foundation, the required hole will be excavated and a rebar cage and anchor bolts will be placed into the excavation. The excavation will then be filled with concrete to a point where the rebar cage and anchor bolts are covered leaving a typical one to two-foot reveal of the foundation above grade with exposed threaded anchor bolts. The complete caisson will then be allowed to cure. Typical equipment for this phase of construction would include: dump trucks, drill rigs, cranes, vacuum trucks, concrete mixers, and tanker trucks.

Structure setting – For base plate structures (mounted on concrete foundation), the above-grade structure would be placed on the anchor bolt pattern, leveled, and tightened down. For direct-embedded structures, the base section would be installed, leveled, and backfilled with granular or flow-able fill. After that, the top section or sections will be installed. At each section, hydraulic jacking systems are typically used to slide the joints together to the engineered and fabricated tolerances. Equipment used for this phase of construction would include cranes and bucket trucks at each structure location.

Wire stringing and clipping – Once there are a sufficient number of structures set consecutively in a row to support a wire pull, the equipment for the wire pull is mobilized to the pull area and is set up. The conductor and static wires are then pulled and clipped into place. This stringing and clipping activity requires access to each structure with a bucket truck, crane, or helicopter. Other handling equipment used for this phase of construction includes reel trailers, wirepullers, and related stringing equipment.

Removal of Existing Facilities - Where replacing or overbuilding existing transmission circuits, the existing structures and wire will be removed. The removed materials will be evaluated to determine their appropriate disposition as discussed in **Section 5.5.2.4**. Typical equipment used includes cranes, bucket trucks, reel trailers, wirepullers, and related stringing equipment.

Cleanup and Restoration of ROW - Upon completion of construction, cleanup and site restoration occurs. This includes removing construction mats, TCSBs, and other material or debris from the ROW. Any necessary seedbed preparation and seeding is performed along with BMPs. Typical equipment used for these activities include mat trucks, bobcats, pickup trucks, and other light-duty vehicles.

Demobilization and Laydown Yard Cleanup - The last step in the construction process is final cleanup of the laydown yards by removing all items such as trailers, security fence, left over materials, storage containers, portable toilets, dumpsters, construction mats, tools, and equipment from the Project site. Once the final laydown restoration is complete per contractual agreement with the applicable landowner, the construction phase is complete.

5.5.2.1 Size of Excavations

It is anticipated that a large number of foundations for the steel structures will be drilled-pier, poured-concrete foundations. Because of diverse loadings and soil conditions, the cylindrical foundations will take on a variety of sizes. The drilled-pier, poured-concrete foundations will range from five to 14 feet in diameter and from 20 to 60 feet in depth. Consequently, the volume of the holes is anticipated to range from 20 cubic yards to in excess of 150 cubic yards on several of the largest foundations. Most holes will be in the range of 30 to 60 cubic yards.

5.5.2.2 Type of Construction Machinery

The types of construction machinery to be used by the Applicants is in Section 5.5.1, which generally describes the major construction activities, their approximate sequence, the typical construction machinery used in each phase of construction, and the anticipated impacts associated with each activity.

5.5.2.3 Construction Disturbance Zone

Transmission line construction will be confined to the ROW, identified access routes, laydown yards and staging areas. Most disturbances will likely occur in the area immediately surrounding transmission line structures. In areas where access cannot be gained from existing roads, some disturbance from vehicular traffic may also occur. Disturbance at these areas may include clearing of vegetative cover, soil compaction, vehicular tracking, and some topsoil disturbance.

5.5.2.4 Spoil Materials Management

Excavated soil may be thin spread on surrounding upland areas and stabilized depending on site conditions, landowner preferences, and environmental requirements. Soil may also be hauled to an approved disposal site. Temporary stockpiles of excavated soils and woody debris resulting from ROW clearing and construction will be required throughout the course of construction. While specific locations have not been determined, it is anticipated that minor soil piles may be required adjacent to excavations for the new transmission line structures and within the laydown yards. Stockpiles will be placed in upland locations. Stock piled materials will be prevented from entering any wetlands or waterways by the use of proper erosion control methods such as silt fence, silt socks, or wattles.

If contaminated materials are encountered during the construction, spoils will be isolated and steps will be taken to determine disposal requirements in accordance with applicable regulations.

5.5.3 Unique Construction Methods

Unique construction methods that may be employed on the Project include light-duty helicopter usage, heavy-lift helicopter usage, micro-piles, helical piers, vibratory or hammer driven piles, and vibratory cans. This information required by the Transmission Application Filing Requirements Sections 5.5.3.1-3 is provided below:

<u>Light-Duty Helicopters</u>

Light-duty helicopters may be used along the entire length of the Project. The primary use for light-duty helicopters is to assist in stringing operations and the installation of conductor and shield wire accessories. Applications include:

- Pulling in stringing ropes;
- Installing spacers, dampers, shunts and/or bird diverters;
- Clipping in conductor;
- Providing logistical support for the installation and removal of stringing blocks; and
- Assistance with alternative foundation installations.

Light-duty helicopters are beneficial because they:

- Decrease total Project construction time;
- Allow work in remote or inaccessible locations;
- Reduce environmental impacts;
- Minimize right-of-way intrusion; and
- Minimize matting in sensitive areas.

Disadvantages of using light-duty helicopters are:

- High cost for mobilization/demobilization;
- Potential for community impacts;
- Difficult to coordinate and schedule;
- Very sensitive to weather conditions; and

- Have the potential to disturb birds nesting in close proximity to the ROW or landing zone.

<u>Heavy-Lift Helicopters</u>

Applications for heavy-lift helicopters are more limited than light-duty helicopters, notably the transport of equipment and material to remote locations. Heavy-lift helicopters may be employed to carry materials (e.g. poles, hardware, and grout) or equipment (compact drill rigs) to the ridge tops, and for structure setting.

The benefits for this type of approach include:

- Allows work in remote or inaccessible locations;
- Eliminates the need for extensive road building for access; and
- Reduces environmental impacts.

Disadvantages of heavy-lift helicopters are:

- Only a few in existence, so very difficult to schedule with long lead-times;
- Sensitive to weather conditions;
- Heavy impact on design and fabrication of structures;
- Potential for greater community impacts;
- Higher cost for mobilization and demobilization; and
- Have the potential to disturb birds nesting in close proximity to the ROW or landing zone.

To efficiently use heavy-lift helicopters to transport material and equipment to remote sites, marshaling/laydown yards are chosen to best utilize existing road networks. The typical distance between yards is about five miles, making the one-way flight distance no more than 2.5 miles. Ground crews at these yards assemble the pole sections, kit material, and stage any equipment that will be transported to the pole location. Setting crews at the pole locations take receipt of the material and equipment, and assist the helicopter crew in setting or topping the transmission line structure.

<u>Micro-piles</u>

One alternative to traditional drilled pier foundations, are micro-piles. Micropiles, also known as mini-piles (and less commonly as pin piles, needle piles and root piles), are deep foundation elements constructed using high-strength, small-diameter steel casing and/or threaded bar generally and have a diameter in the range of three to 10 inches. Micropiles may be used in remote and rocky locations. Areas that would lend themselves to the use of heavy-lift helicopters would also be a likely location for the installation of micro-piles. This would include both the east and west bluffs of the Mississippi River and possibly other inaccessible remote rocky areas that are identified along the route during design.

Micro-piles are a good alternative to traditional drilled pier foundations because the logistical support for construction results in a lighter environmental footprint than for traditional drilled pier installations. Since all material and equipment needed for installation can be flown to the structure location, there is no need for road building to provide access.

Although access to the structure location either within the ROW or off-ROW is still necessary, the construction vehicles are limited to small excavators and pick-up trucks as opposed to cranes and concrete trucks used in traditional foundations. Accordingly, the lighter footprint reduces environmental impacts to the access route.

Typically, the casing/threaded bar is advanced to the design depth using a drilling technique. Reinforcing steel in the form of an all-thread bar is typically inserted into the micro-pile casing. High-strength cement grout is then pumped into the casing. The casing may extend to the full depth or terminate above the bond zone with the reinforcing bar extending to the full depth. The finished micro-pile resists compressive, uplift/tension, and lateral loads and is typically load tested in accordance with ASTM standards. The relatively light and compact micro-pile drill rig allows installation in areas with restricted access or low headroom.

<u>Helical Piers</u>

Another alternative to traditional drilled pier foundations is the installation of helical piers. A helical pier is a pre-manufactured steel deep foundation element consisting of a central steel shaft (usually square), and one or more helical shaped bearing plates (helices). The element is similar to a large screw. The most likely application for helical piers is soil strata indicating expansive soils, a high-water table, fill, or other unstable conditions in locations requiring a deep foundation.

Equipment needed for installation of helical piers are a rotary drill that can be mounted on various pieces of equipment and pickup trucks. Similar to micropiles, material and equipment can be flown in by helicopter in hard to access areas. Advantages and disadvantages for helical piers are the same as for micro-piles above.

A helical pier is installed by rotating (screwing) it into the ground. Each helical bearing plate is formed into a screw thread with a uniform defined pitch. The helical pile is installed into the ground until the helical plates are located in load bearing soil.

Clusters of helical piers are installed together to provide foundation support for steel transmission structures. The clusters are tied together with a pile cap. For more information on a pile cap, reference the description in the vibratory pile section below.

<u>Vibratory Piles</u>

A third alternative to traditional drilled pier foundations is vibratory or hammer driven piles. A pile foundation consists of installing a cluster of steel piles to a depth of as much as 120 feet. This type of foundation is used where poor soil conditions would result in excessively large drilled pier foundations. Vibratory piles can be installed either with conventional pile driving hammers or by vibratory methods.

Advantages of using vibratory or hammer driven piles are:

- Minimize the amount of matting needed to accommodate concrete truck traffic;
- Allow for large reduction in the volume of spoil excavation; and

- Low ground pressure tracked equipment can reduce environmental impacts to the access route.

Disadvantages of using vibratory or hammer driven piles are:

- Rental of vibratory hammer is costly;
- Higher risk of failure if any portion of the casing comes across an obstruction during the vibratory process; the casing will either shift off level or stop completely; and
- Soil conditions need to be conducive to this installation method.

A rectangular shaped concrete pile cap is installed to tie the pile cluster together to form a structural unit. The pile cap could vary in size from 10 to 30 feet wide, 20 to 40 feet long, and 3 to 6 feet thick. The bottom of the pile cap is installed to a depth of seven to 10 feet below grade. Above the pile cap a concrete stem is installed in which the anchor bolts are installed and on which the pole will rest. The stem is either cylindrical or square and will have nominal outside dimensions of six feet to 13 feet. The stem is structurally anchored into the pile cap with reinforcing bars. For this type of foundation, after the cluster of piles is advanced to an appropriate depth to develop structural capacity, several feet of soil are removed to accommodate the dimensions of the pile cap. Soil is removed by use of a backhoe and transported to an approved upland location for disposal or dispersal. Forms for the pile cap and stem are installed, anchor bolts and reinforcing rods are placed, and concrete is poured. After the concrete has properly cured, soil is placed over the pile cap leaving only the top portion of the stem exposed with an appropriate amount of reveal.

Construction traffic for vibratory or hammer driven piles is considerably heavier than that used for micro-piles, as a large track or rubber tired crane would be needed to install the piles.

<u>Vibratory Caisson</u>

For lightly loaded structures (tangents) in sandy soil, vibratory caissons may be employed as an alternative to vibratory or hammer driven piles. The vibratory caisson is a special case type of pile whereby an inverted steel caisson is vibrated into the soil to serve as the foundation for the steel pole. The benefits of this type of installation are the same as those for vibratory or hammer driven piles.

Vibratory driven steel caisson installation consists of a crane and a vibratory hammer, which vibrates the steel cylinder foundation. The weight of the steel and the vibratory hammer pushes the foundation into the ground.

5.5.4 Substation Construction Impacts

Hill Valley Substation

The Hill Valley Substation facilities are proposed to be sited on roughly 80 acres of land. Approximately 22 acres of the site will be used for the substation, access drive, and stormwater drainage features. ATC will create and submit the Stormwater Management and Erosion Control Plan, as part of the Stormwater Management Permit application to the WDNR, for the Hill Valley Substation after final design is completed.

Site preparation would include installing erosion control BMPs, stripping topsoil, and hauling in structural fill to build up the subgrade for the substation pad. Once the substation pad is built to the subgrade, all areas will be restored and the site will be ready for use.

Construction within the newly created substation pad will consist of drilled pier foundations ranging in size from three to seven feet in diameter and 10 to 25 feet deep. The foundations will be installed to support transmission line dead-end structures, static masts, and bus and equipment support structures. Slabs-on-grade nine feet by 32 feet and up to three feet thick will be used for 345 kV circuit breakers, and eight-foot square by two feet thick will be used for 138 kV circuit breakers. The control building will be supported by a perimeter wall up to five feet deep set on a spread footer with pier supports. Transformer and reactor secondary oil containment will be a concrete-lined pot filled with stone. Conduit for control and communication cables and grounding conductor will be installed prior to the placement of the final layer of crushed rock surfacing. The ground grid will be installed 18 inches below the subgrade surface throughout the substation pad and extend five feet outside the substation security wall.

Eden Substation

At the Eden Substation, all modifications will be within the existing fenced area. No new foundations will be installed. No soil disturbance is anticipated.

Cardinal Substation

At the Cardinal Substation, modifications will be within the existing fenced area. Construction within the substation includes drilled pier foundations ranging in size from three to seven feet in diameter and ten to 25 feet deep. The foundations will support transmission line dead-end structures, static masts, and bus and equipment support structures. Slabs-on-grade that are nine by 32 feet and up to three feet thick circuit breakers. Spoils from the excavation will be removed from the site. Where there is disturbance associated with installing underground conduit for control and communication cables, soil removed will be returned to the trench, and crushed rock surfacing will be added as needed.

Nelson Dewey Substation

At the Nelson Dewey Substation, all modifications will be within the existing fenced area. Construction within the substation includes drilled pier foundations ranging in size from three to five feet in diameter and 10-25 feet deep. The foundations will support transmission line dead-end structures, and bus and equipment support structures. Slabs-on-grade that are eight feet square and up to two feet thick will be used for the circuit breaker. Spoils from the excavation will be removed from the site. Where there is disturbance associated with installing underground conduit for control and communication cables, soils removed will be returned to the trench, and crushed rock surfacing will be added as needed.

Stoneman Substation

At the Stoneman Substation, all modifications will be within the existing fenced area. No new foundations will be installed. No soil disturbance is anticipated.

Wyoming Valley Substation

At the Wyoming Valley Substation, all modifications will be within the existing fenced area. No new foundations will be installed. No soil disturbance is anticipated.

5.5.5 Staging Areas (Laydown Yards) and Temporary Work Space

Laydown yards will be required throughout construction for the setup of job trailers as well as storage and staging of construction equipment and material. Preliminary locations for approximately 16 laydown yards have been identified based on the construction requirements for the transmission line, proximity to work areas, and environmental and landowner impacts. These potential yards may change or additional sites may be identified at a later date based on negotiations with landowners and the updated construction needs of the Project. The laydown yards are selected to minimize the amount of disturbance and preparation required to provide suitable surfaces for temporary storage and staging of construction equipment and material. For example, sites that are paved and/or have been previously graded and cleared of vegetation, such as parking lots, old gravel pits, and fields are ideal locations for laydown yards.

A typical laydown yard is about 10 acres with a minimum of a 30-foot-wide driveway for ingress and egress. If a selected site is located in close proximity or upslope of a wetland or waterway, appropriate erosion control measures will be implemented to prevent impacts.

In addition to the laydown yards, helicopter landing zones/pads may be required along the Project corridor. Typically, heavy-lift helicopters will require temporary laydown yards of one to two acres to provide enough space for the landing pad, tower assembly, and equipment and material storage. Typical spacing for heavy-lift helicopter landing zones is five to seven miles. Typically, light-duty helicopters require a 50-foot by 50-foot landing pad, spaced every three to four miles in close proximity to the ROW.

Once a route is ordered, helicopter landing zones/pads will be identified based on the construction techniques and design criteria of the Project. It is preferable to utilize sites that are in close proximity to the ROW, relatively flat (1 - 2% slope), require minimal site preparation and are free of obstructions and debris for safe equipment movement. For example, sites such as vacant parking lots, quarries, gravel pits or fallow fields are suitable locations for helicopter landing pads. Compacted gravel or matting is typically used to construct the actual landing pad and water is typically applied to surrounding soil to control dust during helicopter operation.

Refueling is generally provided by fuel trucks; however, a fuel tank may be spotted at longer duration landing zones.

During construction, temporary workspace for wire pulling/handling areas will be required approximately every 10,000 feet along the route. This distance will depend on the type of conductor that will be used. Wire pulling/handling areas will be located in open upland areas where possible.

The potential laydown yards are shown on site maps included in **Appendix A, Figure 7**. Land use is identified, based on aerial photo interpretation, in the table below.

Table 5.5.5-1 Potential Laydown Yards

ID	Name/Location	County	Land Use
LY-01	Nelson Dewey Generating Station	Grant	Stockyard
LY-02	USH 18/Stockyard Road	Grant	Agricultural
LY-03	Stoneman Generating Station	Grant	Stockyard/Agricultural
LY-04	STH 133	Grant	Agricultural
LY-05	STH 133/W Haas Lane	Grant	Pasture
LY-06	Southwest Road	Grant	Gravel Pit
LY-07	Bluff Lane	Grant	Gravel Pit
LY-08	STH 80/Enterprise Drive	Grant	Developed/Pasture
LY-09	USH 151/Bonner Road	Lafayette	Agricultural
LY-10	STH 80/ATC Property	Grant	Agricultural/proposed substation site option
LY-11	STH 80	Iowa	Gravel Pit
LY-12	Whitson Road/USH 18	Iowa	Gravel Pit
LY-13	Survey Road/USH 18	Iowa	Gravel Pit
LY-14	Industrial Drive/Ernie Drive	Iowa	Gravel Pit
LY-16	STH 78/USH 18	Dane	Gravel Pit
LY-17	Twin Valley Road	Dane	Gravel Pit

If additional laydown or staging areas or temporary workspaces are required, the Applicants will notify the Commission of these new locations and will submit the necessary information to the PSCW prior to establishing any such areas in accordance with Wis. Admin. Code § PSC 111.71.

5.5.6 Off-ROW Access Roads

Wherever possible, the construction crews will access the pole locations down the ROW or directly from public roads that intersect the ROW, unless the contractor is able to arrange for alternative access that minimizes environmental and/or landowner impacts.

In some areas there are physical limitations such as steep slopes within the ROW preventing direct access from public roads or reaching structures from within the ROW, therefore off-ROW access routes will be needed. Preliminary routes have been identified based on a review of existing mapping and aerial photography data, and field reviewed where accessible. These routes are listed in **Appendix B, Table 8** and shown on **Appendix A Figures 4A, 4B and 4C**. During final construction planning, these routes may be refined as new information becomes available and landowner negotiations begin. For the purpose of this evaluation, a 30-foot width was assumed for off-ROW access routes. As construction plans are finalized during landowner negotiations areas may be identified where greater than 30-feet may be required, for example, where an existing path has a turn that is sharper than the turning radius of the construction and material delivery vehicles.

Where possible, existing farm lanes (gravel and/or grassed two-track), driveways and existing cleared forest roads or trails will be used for off-ROW access, along with existing waterway crossings such as bridges or culverts.

Some of the off-ROW access paths may need improvements to allow construction equipment to move safely to and from the Project ROW. These improvements may include vegetation removal and/or grading. Although grading (cut/fill) is not anticipated at this time for off-ROW access routes, the need for this may be identified later to provide safe construction vehicle access (i.e. on slopes that are very steep or on side slopes). In limited areas gravel may be placed to facilitate vehicle access along certain routes, but at this time the need for gravel has not been identified. Permanent wetland fill associated with off-ROW access paths is not proposed. Access within wetlands may include conducting work during dry or frozen conditions, using low ground pressure equipment or placing temporary construction mats. Where grading or the placement of gravel is required, erosion control or storm water best management practices will be implemented.

Most of the off-ROW access paths would be restored to pre-construction conditions. Depending on landowner preferences, negotiations, and requirements, the improved access paths may be left in place. Some of the off-ROW access routes may be required for long-term maintenance and safe operation of the transmission line.

If additional required off-ROW paths are identified, the Applicants will complete an environmental review of these paths and submit the necessary information to the PSCW prior to establishing any such areas in accordance with Wis. Admin. Code § PSC 111.71 or 112.073.

5.6 Substation Information

5.6.1 Description, Diagrams, Graphics

Hill Valley Substation

The Proposed Substation Site for the intermediate Hill Valley Substation is comprised of an 80-acre property owned by ATC, that is presently used for agricultural production and currently comprised of corn, soybeans, and alfalfa. The site has moderately rolling topography with topographic highs along the northeastern extent of the site and topographic lows in the northwestern area. The property generally slopes to the south and northwest. Soils mapped onsite are mostly moderately well or well drained. Based on a field review of the site during June 2017, no wetlands or waterways were identified on the property.

The Other Substation Site for the intermediate Hill Valley Substation is comprised of an 80-acre property that is also currently used for agricultural production (primarily row crops). The site has topographic highs along the central area of the site, generally sloping to the south and northwest. Soils mapped onsite are mostly well drained. The soil survey also identifies a mine pit and dumps map unit, which may indicate previous mining excavations and waste disposal. Based on an off-site aerial review, no wetlands or waterways were identified on the property. This Other Substation Site is being used as an alternative by the Rural Utilities Service in the federal Environmental Impact Statement being prepared for the Project.

The new Hill Valley Substation will be built as a four-position 345 kV ring bus and three-position 138 kV ring bus with one 345/138 kV transformer. The site has an ultimate design to accommodate a full build out to a six-position 345 kV breaker-and-a-half bus configuration, eight-position 138 kV breaker-and-a-half bus configuration, and two 345/138 kV autotransformers.

The scope of work at the Hill Valley Substation would include:

- Installing five 345 kV circuit breakers, foundations, and control cables for transmission line switching;
- Installing three 138 kV circuit breakers, foundations, and control cables for transmission line switching;
- Installing one 345/138 kV, 500 MVA autotransformer, foundation, and control cables;
- Installing one 345 kV 80 MVAR oil filled shunt reactor with foundation, secondary oil containment and control cables;
- Installing 138 kV line steel dead-end structures with foundations to terminate the transmission lines;
- Installing 345 kV line steal dead-end structures with foundations to terminate the transmission lines;
- Installing a new building complete with auxiliary systems to house all necessary protection and control, communication, and SCADA equipment;

- Installing fiber optic communication and SCADA equipment for system protection, remote control, and monitoring of the substation; and
- Installing disconnect switches, buswork, lightning protection structures, instrument transformers, surge arresters, and all appurtenances for a complete substation installation.

The one-line diagram and layout configuration for the Hill Valley Substation is shown in **Appendix C, Figures 15 and 16**. The preliminary grading plan for the Proposed Substation Site is provided in **Appendix C, Figure 17**.

Cardinal Substation

The scope of work required to connect the proposed 345 kV transmission line to the Cardinal Substation would include:

- Installing two 345 kV dead-end structures with foundations to terminate the transmission line;
- Constructing a 345 kV circuit breaker, foundations, and control cables for transmission line switching;
- Installing a protection and control panel for the new 345 kV transmission line;
- Installing fiber optic communication and SCADA equipment for system protection, remote control, and monitoring of the substation; and
- Installing disconnect switches, buswork, lightning protection structures, instrument transformers, surge arresters, and all appurtenances for a complete substation installation.

The one-line diagram and layout configuration for the Cardinal Substation is shown in **Appendix C, Figures 18 and 19**.

Eden Substation

Connecting the 138 kV transmission line X-16 to the Hill Valley Substation would require the following scope of work at the Eden Substation:

- Replacing a protection and control panel for the 138 kV transmission line to the Hill Valley Substation;
- Installing fiber optic communication and SCADA equipment for system protection, remote control, and monitoring of the substation; and
- Replacing disconnect switches and bus work to meet required ratings.

The one-line diagram and layout configuration for Eden Substation is shown in **Appendix C, Figures 21 and 21.**

Wyoming Valley Substation

The addition of the Cardinal-Hickory Creek Line to the network will increase the fault current at the Wyoming Valley Substation. Nine sixteen-foot ground rods will be installed to mitigate the identified fault current increase.

Nelson Dewey Substation

Connecting the 138 kV transmission line X-16 to the Hill Valley Substation would require the following scope of work at the Nelson Dewey Substation:

- Replacing a protection and control panel for the 138 kV transmission line to the Hill Valley Substation;
- Installing fiber optic communication and SCADA equipment for system protection, remote control, and monitoring of the substation; and
- Replacing disconnect switches and bus work to meet required ratings.

Additionally, if the Applicants' preferred Mississippi River crossing is selected, the following would also need to be added to support the addition of the 161 kV line from the Turkey River Substation:

- Reconfigure the substation with two 161/69 kV transformers, four 161 kV circuit breakers, and five 69 kV circuit breakers;
- Installing one 161 kV line steel dead-end structures with foundations to terminate the transmission lines;
- Installing protection and control panel for the new Turkey River Substation configuration;
- Installing fiber optic communication and SCADA equipment for system protection, remote control, and monitoring of the substation; and
- Installing disconnect switches, buswork, lightning protection structures, instrument transformers, surge arresters, and all appurtenances for a complete substation installation.

The one-line diagram and layout configuration for Nelson Dewey Substation is shown in **Appendix C, Figures 22 and 23**.

Stoneman Substation

If the Applicant's preferred Mississippi River crossing is permitted, the following scope would be needed to support the removal of the 161 kV line and 69 kV line at the existing Mississippi River Crossing:

- Removing the 161 kV and 69 kV transmission line terminals; and
- Removing the existing protection and control relays from control house.

If the existing Mississippi River crossing is permitted, the following scope of work will be needed:

- Removing 69 kV transmission line terminals; and
- Removing the existing protection and control relays from control house.

The one-line diagram and layout configuration for the Stoneman Substation is shown in **Appendix C, Figures 24 and 25**.

6.0 NATURAL RESOURCE IMPACTS

6.1 Forested Land

Forested areas along the routes were quantified as part of the impact analysis (**Section 5.4**) and the resulting acreages are provided in the Land Cover table (**Appendix B, Table 5**) and forested areas are described in the Environmental Impact Table (**Appendix F, WDNR Table 2**).

Forested lands are defined as any wooded landscapes (greater than 20% canopy cover). Narrow tree lines (e.g., wooded fence rows) or windbreaks were generally not included as forested cover.

The following tree size classification system was used based on diameter at breast height (dbh):

- Saplings refer to live trees from one to five inches dbh;
- Pole timber ranges from five to nine inches dbh (softwoods) and from five to 11 inches dbh (hardwoods); and
- Saw timber is greater than nine inches dbh (softwoods) and greater than 11 inches dbh (hardwoods).

6.1.1 Impacted Woodlands

The Preferred and Alternate Routes would begin at the western end of the Project within a mix of agriculture in valleys and ridgelines, with forested lands on steep topography. The central portion of the Preferred Route would pass through a landscape dominated by agricultural use with the far eastern end again in a landscape of agriculture in valley bottoms and forested hills and bluffs. The central and eastern portion of the Alternate Route would continue through a mixture of agriculture confined to valley bottoms and ridgelines with larger contiguous forested tracts on areas of steeper topography.

<u>Preferred Route</u>

The Preferred Route would be largely located along existing cleared transmission line corridors and along highway corridors on Segments Q and S; note that some of these existing corridors would need to be widened for the project, in some cases requiring extensive clearing. A few sub-segments would be located on new corridors that have not been previously cleared of woody vegetation. The forest lands along the Preferred Route are fragmented within a predominantly agricultural landscape. Forests are more prevalent on the west end of the Preferred Route, in the Coulee Section of the Driftless Region, and somewhat less frequent through the central and eastern portion that falls within the savanna section. The easternmost portion of the route would generally encounter more frequent and larger forested areas than the central portion.

Forests along the Preferred Route are typically closed canopy mesic forests, with pole and saw-sized timber, frequently deciduous and occasionally mixed deciduous-coniferous. The deciduous forests are dominated by black walnut (*Juglans nigra*), hickories (*Carya* spp.) and northern red oak (*Quercus rubra*), with a variety of secondary species. Mixed forests are similar to the deciduous forests with the addition of eastern red cedar (*Juniperus virginiana*). Oaks (*Q. macrocarpa, Q. alba*) increase in presence towards the east. Forested wetlands occur occasionally along this route, and are typically hardwood swamps in riparian areas. Dominant species include box-elder (*Acer negundo*) and silver maple (*Acer saccharinum*).

The large majority of the forests are privately owned and in recreational land use. Publicly-owned forest lands are owned by the village of Mount Horeb, the State of Wisconsin (WDNR - Military Ridge Trail; the University of Wisconsin Board of Regents), and Dane County (Black Earth Creek Wildlife Area – Sunnyside Unit).

<u>Alternate Route</u>

Much of the Alternate Route would be located along existing transmission line corridors and a combination of roadway and existing transmission corridors. However, Segments F, L and P would be located on new corridors that have not been previously cleared of woody vegetation, and some of these existing corridors would need to be widened for the Project, in some cases requiring extensive clearing.

The forest lands along the western extent of the Alternate Route are fragmented within a predominantly agricultural landscape, and are similar to the Preferred Route in size, species, ownership and land use, as described above.

The eastern extent of the Alternate Route would be primarily located within the northern part of the Coulee Section of the Driftless Region. Forested lands are the predominant cover type within these areas, generally comprised of large contiguous tracts interspersed by agriculture and grasslands. These forests are closed canopy mesic to dry-mesic forests, with pole and saw-sized timber, frequently deciduous and occasionally mixed deciduous-coniferous. A variety of oaks (*Q. macrocarpa, Q. alba, Q. rubra,* and *Q. velutina*) dominate the overstory, with shagbark hickory (*Carya ovata*), black cherry (*Prunus serotina*), basswood (*Tilia americana*), American elm (*Ulmus americana*), and sugar maple (*Acer saccharum*) occurring frequently. In the mixed deciduous-coniferous forests, white pine (*Pinus strobus*) joins the dominant oaks. To a lesser extent, riparian wetlands and hardwood swamps are located within these segments, dominated by species such as red maple (*Acer rubrum*), eastern cottonwood (*Populus deltoides*), box elder (Acer negundo), green ash (*Fraxinus pennsylvanica*), and American elm (Ulnus americana).

The large majority of the forests along the Alternate Route are privately owned, in recreational land use. Publicly-owned forest lands include the State of Wisconsin (WDNR-Blackhawk Lake Recreation Area, and the University of Wisconsin Board of Regents-UW Research and Conservation Land).

<u>Other Route Segments</u>

The forested lands located along the Other Route Segments are similar to the Preferred and Alternate Routes in size, species, ownership and land use. The forested lands located within the western portion of the Project are generally fragmented within a predominantly agricultural landscape, with larger complexes located along the eastern area of the project.

6.1.2 Managed Forest Law and Forest Crop Law

The Applicants obtained information from the WDNR identifying quarter-quarter (40-acre) sections in which all or some portion of the land is enrolled in the Managed Forest Land (MFL) or the Forest Crop Law (FCL) programs as provided in **Table 6.1.2-1** located in Appendix J.

The full extent to which program participation may be affected cannot be determined based on the information available to the Applicants. If the proposed easement area does not encumber the forested areas on the parcel, there would be no impact to the program. During the easement negotiation process, conflicts between the terms and conditions of the MFL Program Agreement and the proposed easement, if any, will be addressed. If any landowner would be unable to continue in the program, or if the level of participation is impacted, the Applicants will compensate the landowner as appropriate. Due to conflicts between transmission line easements and the obligations of the landowner under the terms and conditions of this program, the land in the easement area may have to be removed from the MFL.

6.1.3 Minimizing Construction Impacts in Woodlands

Trees and brush will be cleared for the full width of the ROW to facilitate construction equipment access and ensure safe clearances between vegetation and the transmission line. Vegetation will be cut at or slightly above the ground surface using mechanized mowers, sky trims, processors, harvesters, or by hand. Rootstocks will generally be left in place except in areas where stump grinding is necessary to facilitate the movement of construction vehicles, or if requested by the landowner.

The cut and scatter method may be used during construction in some areas. The purpose of this method is to minimize the disturbance that may be caused by hauling cut vegetation out of the ROW.

Woody vegetation may be chipped and scattered over the ROW in non-agricultural upland areas through the use of a forestry mower or a chipper. In wetlands or floodplains, care will be taken to ensure the mowed or chipped material is evenly spread, and in compliance with wetland permit requirements. Chipped material derived from onsite locations may be spread as mulch in upland areas to provide surface protection from erosion along access paths. Upon abandonment of access routes, mulch will be spread evenly so that it does not hinder revegetation.

To minimize the spread of oak wilt, the cutting or pruning of oak trees will comply with the requirements of Wis. Admin. Code § PSC 113.051 (applicable between April 15 – July 1). Other recommended restricted times that fall outside of this window will also be followed (e.g. WDNR or local restrictions) if practicable.

Practices that minimize the spread of the emerald ash borer will be employed for the Project. Most of the Project area in Wisconsin is located in the emerald ash borer (*Agrilus planipennis*) quarantine area. Practices that minimize the spread include avoiding movement of ash wood products (logs, posts, pulpwood, bark and bark products, slash and chipped wood from tree clearing) and hardwood firewood from emerald ash borer quarantine areas to non-quarantine areas. *See e.g.* Wis. Admin. Code § ATCP 21.17. Where ash wood products cannot be left on-site, alternative plans will be developed to meet the requirements.

Some of the Wisconsin portion of the Project is located within the gypsy moth (*Lymantria dispar*) quarantine area. Standard practices used in the quarantine area to avoid the spread of the gypsy moth damage include inspections and avoiding movement of wood products (logs, posts, pulpwood, bark and bark products, firewood, slash and chipped wood from tree clearing) from gypsy moth quarantine areas to non-quarantine areas, as per Wis. Admin. Code § ATCP 21.10.

6.2 Grasslands

Grasslands along the routes were quantified as part of the impact analysis (**Section 5.4**) and the resulting acreages are provided in the Land Cover table (**Appendix B, Table 5)** and grasslands areas are described in the Environmental Impact Table (**Appendix F, WDNR Table 2**).

Grasslands are defined as undeveloped landscapes dominated by herbaceous (non-woody) vegetation. Grasslands identified within the Project area include prairies, roadsides, and pastures and fallow fields associated with farm operations. The discussion below does not include herbaceous wetlands.

6.2.1 Type

The grasslands along the Project occur in the cleared areas of the existing transmission line corridors; along roadside areas and embankments; as pastures and fallow fields associated with farm operations; and to a lesser extent in native or restored prairies. The portions of the Project south of STH 18/151 fall within the Project boundary for the Southwest Wisconsin Grassland and Stream Conservation Area, a joint project of the Wisconsin Department of Natural Resources and many other partners, whose goal is to conserve and enhance functioning grassland, savanna, and stream ecosystems across this landscape.

<u>Preferred Route</u>

The Preferred Route is largely located along existing transmission line and highway corridors. Most of these grasslands are dominated by non-native cool season grasses in roadside and agricultural areas. Common species within these areas include Kentucky bluegrass (*Poa pratensis*), smooth brome (*Bromus inermis*), tall fescue (*Lolium arundinaceum*), timothy (*Phleum pratense*), orchard grass (*Dactylis glomerata*), and reed canary grass (*Phalaris arundinacea*). Herbaceous species that are commonly found with the cool season grasses are Canada goldenrod (*Solidago canadensis*), wild parsnip (*Pastinaca sativa*), crown vetch (*Securigera varia*), and Canada thistle (*Cirsium arvense*).

Prairie grasslands, ecosystems dominated by native herbaceous warm season grasses, are scarce along this route. A dry/goat prairie community occurs along the western extent of this route (Feature ID: A-G03), associated with an Alliant Energy prairie restoration area. A weedy, low quality prairie is found west of Edmund (Feature ID: Q-G9) along an abandoned railway grade (a sign was observed denoting this as the Sturdevant-Drysen Memorial Prairie); this may be a remnant of restored prairie. A weedy, low quality prairie, dominated by cool season grasses, but also containing native prairie forbs, is found adjacent to a farmstead along Segment Q (Feature ID: Q-G12).

Grasslands along this route are predominantly privately owned, and used for agriculture or recreation. Roadside grasslands are publicly owned.

Alternate Route

The Alternate Route is generally located along a combination of roadway and existing transmission corridors, and new ROW. Most of these grasslands are dominated by non-native cool season grasses in roadside and agricultural areas. Common species are like those that occur on the Preferred Route including bluegrass, smooth brome, tall fescue, and other species as described above.

A dry/goat prairie community occurs along the western extent of this route (Feature ID: C-G01), associated with an Alliant Energy prairie restoration area. Other prairies occur occasionally along Segment P, which is partially located along existing transmission line and new corridor. Adjacent to Willow Springs Road, a weedy remnant prairie occurs on some rock outcrops, dominated by smooth brome, little bluestem (*Schizachyrium scoparium*) and Ohio spiderwort (*Tradescantia ohiensis*) (Feature ID: P-G11). A large restored prairie area, partially owned by the State of Wisconsin, and partially privately owned, occurs at the Blackhawk Lake Recreation Area (Feature ID: P-G26). This area is dominated by little bluestem, bird's foot trefoil (*Lotus corniculatus*), golden alexanders (*Zizia aurea*), and wild bergamot (*Monarda fistulosa*). There is a degraded remnant dry prairie in the road ROW and along the exposed rock cut adjacent to STH 23 (Feature ID: P-G46).

Grasslands along this route are predominantly privately owned and used for agriculture or recreation. Roadside grasslands that intersect road ROW are publicly owned.

Other Route Segments

Similar to the Preferred and Alternate Routes, grasslands along the Other Route Segments occur mostly along roadside embankments and ROW, and as pastures or fallow fields associated with farm operations. Cool season grasses dominate these areas. One moderately sized restored prairie associated with a private residence occurs north of the unnamed tributary to Schalpbach Creek and the Military Ridge State Trail (Feature ID: U-G3).

Grasslands along this route are predominantly privately owned and used for agriculture or recreation. Roadside grasslands that intersect road ROW are publicly owned.

6.2.2 Minimizing Impacts in Grasslands

The Project will require vehicle traffic over the ROW through grassland areas. Primary considerations for minimizing impacts to native prairie grasslands include minimizing soil disturbances such a rutting and compaction, and preventing and minimizing the spread of invasive species. Impact minimization may include matting through native grasslands, work in frozen conditions and/or during plant dormancy, and use of invasive species best management practices as outlined in **Section 6.6**. Restoration of native prairie and grasslands will include seeding with seed mixes similar to the pre-construction condition.

6.3 Wetlands

6.3.1 Proposed Wetland Crossings

A summary of all wetlands intersecting the routes is presented in **Appendix F, WDNR Table 1 and WDNR Table 2**, and shown on **Appendix A, Figures 3A, 3B and 3C**. Wetlands were identified during field investigations along accessible corridors and/or from review of aerial photographs and other reference material as discussed in **Section 8.3**. In addition, access through several wetlands will be required for off-ROW access. These wetlands are identified in **Section 5.7**; however, they are also briefly addressed in this section.

Numerous wetlands will need to be crossed during transmission line construction, except where alternate access routes can be identified upon final route approval. The following is a summary of the total number of wetland crossings by route.

- The Preferred Route would have 78 wetland crossings.
- The Alternate Route would have 87 wetland crossings.
- There are 41 wetlands that would be crossed by Other Route Segments, however these Other Route Segments do not offer a complete route for the Project.
- The Hill Valley Substation sites do not contain wetlands.

In addition, 2 wetland crossings will be required for off-ROW access along the Preferred Route (along Segments D and S) and 8 crossings along the Alternate Route (along Segments E, I, and P).

6.3.2 Structures within Wetlands

Conceptual transmission structure locations, shown on **Appendix A, Figures 4A, 4B and 4C**, have been developed to identify the potential number of structures constructed in wetlands and to develop preliminary access routes. These structure locations are approximated based on the proposed design spans for the structures that will be used and have been spotted along the alignment to conservatively estimate transmission line impacts. The structure locations will be re-examined during the detailed design phase with the objective of minimizing impact to the extent practicable without adding undue costs or physical impacts to the integrity and reliability of the transmission line design and to accommodate landowner concerns. The estimated number of structures in wetlands provided below may require adjustment during detailed design if previously unknown or unanticipated conditions are encountered prior to final design. Examples of these conditions include: new physical terrain details, which may affect span lengths, or refinement of wetland boundaries (primarily aerial delineated boundaries) once easements are obtained and additional on-site delineations are completed.

Based on conceptual structure locations, the following number of structures along each route are anticipated to be constructed in wetland. Further detail on each wetland including the area of wetland impact, is provided in **Appendix F, WDNR Table 1 and WDNR Table 2**.

- The Preferred Route would have 8 structures in wetlands.
- The Alternate Route would have 17 structures in wetlands.
- The Other Route Segments would have 6 structures in wetlands, though these Other Route Segments do not offer a complete route for the Project.
- The Hill Valley Substation sites would not have structures in wetlands.

6.3.3 Avoiding and Minimizing Impacts in Wetlands

Through the routing and siting process and engineering of final structure locations, the Project will avoid or minimize wetland impacts. However, wetlands occur along each of the proposed routes and some impacts cannot be avoided. Equipment access and pole installation within wetlands will be required during transmission line construction. The use of heavy equipment in wetlands will be minimized to the extent practicable.

Construction disturbance to wetlands will be minimized by one or more of the following techniques:

- completing wetland construction during dry, frozen or otherwise stable conditions;
- the use of equipment with low ground pressure tires or tracks;
- or placement of construction matting to help minimize soil and vegetation disturbances and distribute axle loads over a larger surface area thereby reducing the bearing pressure on wetland soils.

Access roads through wetlands will not require permanent fill. Erosion-control BMPs will be installed where needed to prevent soil erosion into and within wetlands. Any spoils will be removed from the wetlands to an upland area or other approved location.

6.3.4 "Significant" or "High-Quality" Wetlands

The majority of wetlands along all routes are composed entirely or in part of degraded wet meadow, shallow marsh, farmed wetland, hardwood swamp, and shrub carr communities, characterized by low plant diversity and dominance by various invasive species, most commonly including reed canary grass and invasive cattails, and disturbance tolerant native species, such as box elder and cottonwood. Higher quality wetland communities occur along the Project corridor, and include communities that are composed of fairly intact native wetland vegetation. Examples of higher quality wetlands are found along portions of the Preferred

Alternate and Other Route Segments, including sedge meadow, wet prairie, shrub carr, hardwood swamp, shallow marsh, deep marsh, and shallow open water communities.

In addition to the higher-quality wetland communities noted above, other wetlands along each route may be notable for additional characteristics such as structural diversity (i.e., mix of cover types; suitable rare species habitat), and/or hydrological attributes/functions (e.g., floodplain, riparian, open water interspersion). Higher-quality and other notable wetlands are listed by segment and route below. Refer to **Appendix F, WDNR Table 2** for further descriptive details. Aerially interpreted wetlands were typically not included in this evaluation due to the difficulty in remotely assessing wetland quality.

6.3.4.1 Locations of Significant or High-quality Wetlands

The location of all wetlands, including the significant or high-quality wetlands listed in **Section 6.3.4** are shown on **Appendix A, Figures 4A, 4B and 4C**.

6.3.4.2 Wetland Types

For each of the significant or high-quality wetlands listed below, the corresponding wetland type is provided immediately following the wetland's Feature ID (e.g., P-W01, wet meadow associated with Badger Hollow Creek). In addition, the primary characteristics of each wetland (e.g., dominant species, hydrogeomorphic position, surrounding land use, etc.) are described in the resource description in **Appendix F, WDNR Table 2**.

<u>Preferred Route</u>

<u>Segment D</u>: D-W05 and D-W06 (large floodplain forest and wet meadow associated with Pigeon Creek); D-W08, D-W09 and D-W10 (large floodplain forest and wet meadow associated with Pigeon Creek); D-W12 and D-W13 (mixed native/reed canary grass wet meadow and floodplain forest associated with un-named tributary UNT to Pigeon Creek); D-W15 (wet meadow associated with UNT to Platte River); D-W16 (native wet meadow); D-W20 and D-W21 (wet meadow and shrub-scrub wetland); D-W22 (wet meadow associated with Platte River); D-W23 (mixed native/reed canary grass wet meadow); D-W25 (large mixed native/reed canary grass wet meadow associated with Platte River); D-W26 (large wet meadow wetland associated with Platte River); D-W29 (mixed native wet meadow associated with UNT to Platte River); D-W31 (large wet/sedge meadow associated with Platte River); D-W32 (large wet meadow associated with Platte River).

<u>Segment Q</u>: Q-W03/Q-W03a (wet meadow/shallow marsh/shrub carr associated with Pecatonica River); Q-W10 (wet meadow/sedge meadow/hardwood swamp associated with UNT to Dodge Branch).

<u>Segment S</u>: S-W01 (sedge meadow associated with UNT to Dodge Branch); S-W02 (wet meadow associated with UNT to Smith Conley Creek); S-W13 (wet meadow/hardwood swamp associated with UNT to Gordon Creek); S-W17 (shrub carr associated with West Branch Sugar River); S-W19 (shrub carr associated with Deer Creek).

Segment T: T-W01a (forested wetland/farmed wetland associated with Schalpbach Creek); T-W02 (native wet meadow associated with UNT to Sugar River).

Segment Y: Y-W03 (sedge meadow / wet prairie associated with Black Earth Creek); Y-W08 (shallow marsh/wet meadow/hardwood swamp associated with pond); Y-W09 (diverse wetland complex consisting of wet meadow/sedge meadow/shallow marsh/deep marsh associated with pond).

Alternate Route

Segment E: E-W01 (shrub-scrub dominated by native species); E-W03 and E-W04 (wet meadow/forested wetland complex); E-W06 (wet meadow dominated by prairie cordgrass, associated with McCartney Branch); E-W12 and E-W13 (wet meadow/forested wetland associated with UNT to Boice Creek); E-W14 (wet meadow associated with UNT to Boice Creek); E-W15 (wet meadow associated with Boice Creek); E-W16 and E-W17 (wet meadow associated with Boice Creek and Graham Hollow Creek); E-W22 (wet meadow associated with Yankee Hollow Creek); E-W25 (wet meadow associated with UNT to Platte River); E-W26 (wet meadow associated with Platte River); E-W28 and E-W29 (wet meadow/forested wetland associated with UNT to Platte River); E-W30 and E-W31 (wet meadow/forested wetland associated with UNT to Platte River).

Segment G: G-W06 (wet meadow associated with Galena River).

Segment I: I-W02 (wet meadow associated with UNT to Livingston Branch); I-W03 (wet meadow dominated by prairie cordgrass associated with UNT to Livingston Branch); I-W04 (wet/sedge meadow associated with Livingston Branch).

Segment L: L-W01 (wet meadow associated with Platte River).

Segment P: P-W02 (native wet meadow associated with UNT to Blue River); P-W03 (sedge meadow associated with Blue River); P-W04 (sedge meadow/wet meadow associated with UNT to Blue River); P-W05 (sedge meadow associated with UNT to Blue River); P-W10 (wet meadow/hardwood swamp associated with Otter Creek); P-W10h (wet meadow/sedge meadow/hardwood swamp complex along riparian corridor); P-W10m (degraded sedge meadow/hardwood swamp associated with Mill Creek); P-W12a (sedge meadow/wet meadow/shallow marsh associated with West Branch Blue Mounds Creek); P-W12b (wet meadow/shrub carr/hardwood swamp associated with West Branch Blue Mounds Creek); P-W13 (extensive wetland complex of sedge meadow/shallow marsh/hardwood swamp associated with East Branch Blue Mounds Creek); P-W13a (hardwood swamp/wet meadow associated with UNT to East Branch Blue Mounds Creek); P-W15 (shallow marsh/farmed wetland/shrub carr/hardwood swamp associated with Vermont Creek); P-W17 (shrub-carr/hardwood swamp/wet meadow/farmed wetland associated with UNT to Vermont Creek); P-W20 (wet meadow/hardwood swamp associated with Garfoot Creek).

Segment Y: Y-W03 (sedge meadow/wet prairie associated with Black Earth Creek); Y-W08 (shallow marsh/wet meadow/hardwood swamp associated with pond); Y-W09 (diverse wetland complex consisting of wet meadow/sedge meadow/shallow marsh/deep marsh associated with pond).

Other Route Segments

Segment R: R-W05 (sedge meadow/wet meadow/hardwood swamp associated with Pecatonica River); R-W06 (wet meadow associated with UNT to Pecatonica River); R-W07 (wet meadow associated with UNT to Sudan Branch); R-W08 (sedge meadow/wet meadow associated with Sudan Branch); R-W09 (hardwood swamp/wet meadow complex); R-W10 (sedge meadow/hardwood swamp); R-W14 (extensive wet meadow/sedge meadow/hardwood swamp associated with Mineral Point Branch); R-W15 (sedge meadow/wet meadow associated with UNT to Mineral Point Branch); R-W16 (forested wetland/wet meadow associated with UNT to Dodge Branch); R-W16a (sedge meadow associated with Dodge Branch); R-W19 (wet meadow/spring head associated with UNT to Dodge Branch); R-W19a (hardwood swamp associated with UNT to Dodge Branch).

Segment S: S-W01a (sedge meadow/wet meadow associated with UNT to Dodge Branch).

Segment Z: Z-W02 (shallow marsh/hardwood swamp/open water pond, a research/conservation area owned by University of Wisconsin).

A number of wetlands along the Project have been identified in WDNR Tables 1 and 2 as Areas of Special Natural Resource Interest (ASNRI), in accordance with Wis. Admin. Code § NR 1.05. Wetlands are considered ASNRI when they fall within (entirely or in part), or are contiguous with, one or more of the designated special features listed in NR 1.05 (e.g., trout streams, state wildlife areas, parks, etc.). However, despite their association with these special features, not all ASNRI-designated wetlands are significant or of high quality; many are affected by historical and/or ongoing land use practices (e.g., agriculture, development, etc.) that have caused degraded conditions such as altered hydrology or infestation with invasive plant species.

6.3.4.3 Minimizing Impacts in Significant or High-Quality Wetlands

The process that was undertaken to avoid and minimize impacts to wetlands, discussed in **Section 8.2**, included consideration for avoiding significant or high-quality wetlands, as well as minimizing the number of wetland crossings and the number of structures spotted within wetlands.

During construction, the implementation of BMPs along with the Applicants' standard environmental protection practices will provide for further avoidance and minimization of wetland impacts. Through careful attention to access routing, consideration of off-ROW access, types of equipment used, construction time of year, sedimentation control, and the implementation of other relevant site-specific measures (further described in **Section 6.3.3**), the Applicants will minimize impacts to significant or high-quality wetlands, to the extent practicable in each case. Where necessary to ameliorate minor impacts such as rutting and vegetation disturbance due to equipment operation and mat placement in wetlands, site restoration activities will be implemented, monitored, and remedial measures applied (as necessary) until established restoration goals are achieved.

As detailed in **Appendix F, WDNR Table 2**, the construction of either route will result in the loss of a minimal amount of wetlands along the length of the Project (total area of foundations or structures, and backfill) and a larger area of forested wetland conversions. In areas where new ROW is needed, the lands will be cleared of trees and other woody vegetation, resulting in a conversion to wet meadow or shrub-carr wetland types.

6.4 Waterbodies/Waterways

6.4.1 Proposed Waterbody or Waterway Crossings

A summary of all waterbodies and waterways (hereafter collectively referred to as "waterways") intersecting the routes is presented in **Appendix F, WDNR Table 1 and WDNR Table 2**, and shown on **Appendix A, Figures 4A, 4B and 4C**. The identification of waterways was based on review of the WDNR 24K Hydrography layer, National Agriculture Imagery Program aerial photographs (from 2015), Pictometry that utilized photographs of the corridors from 2016, and field observations along accessible routes. Features with distinguishable beds and banks and evidence of scour were considered to be a waterway, regardless of the width or if it was identified in the WDNR 24K Hydrography layer. Several waterways appear on WDNR 24K Hydrography that were not evident based on field and/or aerial photograph review. These features are identified in **Appendix F, WDNR Table 2** (but not given a unique waterway label) with the explanation that it is our interpretation these features would likely not be considered navigable; although the WDNR has final jurisdictional authority over navigability determinations. Because these waterways were not evident based on field/aerial photograph review, they were not identified on **Appendix A, Figures 4A, 4B and 4C**.

In addition, several waterway crossings will be required for off-ROW access. These waterways are identified in **Section 5.7** and included in this section.

The number of proposed waterway crossings for each route is listed below, and listed by segment in **Appendix F, WDNR Table 1 and WDNR Table 2**.

- The Preferred Route would cross waterways in 89 locations.
- The Alternate Route would cross waterways in 93 locations.
- The Other Route Segments would cross waterways in 50 locations, though these Other Route Segments do not offer a complete route for the Project.
- There are no waterways on the Hill Valley Substation sites, although intermittent tributaries to the Platte River are located north and south of both substation sites.

6.4.2 Structures below the Ordinary High Water Mark (OHWM)

No transmission line structures are proposed to be placed below the OHWM of waterways along the Preferred and Alternate Routes or Other Route Segments. It is not expected that any temporary structures below the OHWM of waterways will be required for construction access.

6.4.3 Need and Method for Constructing Crossings

The crossings discussed in **Section 6.4.1** require either a TCSB or will only be crossed for wire pull activities (no stream crossing with vehicles is required for wire pulls). All proposed crossings are required to allow for safe and efficient construction access along both routes. In addition, several waterways are proposed to be crossed as part of off-ROW access requirements (refer to **Section 5.7**). Seventeen (17) waterway crossings are anticipated for off-ROW access along the Preferred Route, 22 along the Alternate Route, and 1 along the Other Route Segments. These crossings either use existing culverts and bridge crossings or require the use of a TCSB.

TCSBs will be placed to avoid in-stream disturbance. Each TCSB will consist of construction mats and/or steel I-beam frames, or other similar material, placed above the ordinary high-water mark (OHWM) on either side to span the stream bank. Preparation for setting the bridge may include minor blading and excavation confined to the minimum area necessary for safe bridge installation. Removal of low-growing trees, shrubs, and other shoreline vegetation will be kept to a minimum.

Additional detail regarding waterway crossings (e.g., typical detail drawing of a TCSB crossing, photos of waterways observed in the field) is provided in **Section 8.0**.

6.4.4 Minimizing Impacts to Waterway Crossings

The use of TCSBs will be minimized where possible by accessing the ROW on either side of the stream or by using existing public crossings to the extent practical. The Applicants will work with private landowners to identify alternate access routes to further reduce the use of stream crossings, if possible.

For those streams that will not be crossed by construction vehicles and where stream crossing permits have not been acquired, wire would be pulled across those waterways by boat, helicopter, or by a person traversing across the waterway. Wire stringing activity may require that waterways be temporarily closed to navigation.

In addition, an Erosion Control Plan will be prepared if a route is approved, and BMPs will be employed near waterways to minimize the potential for erosion and to prevent sediment from entering the waterway.

6.4.5 Identification of Special Waterways

Waterways along both routes considered to be ASNRI (including Outstanding or Exceptional Resource Waters, Trout Streams, and Wild or Scenic Rivers) are identified in **Appendix F, WDNR Table 2**.

Refer to **Section 6.4.4** for procedures to avoid, and minimize impacts associated with all waterway crossings. In addition, the following provides further methods, which will be based on site-specific information if a route is approved, to minimize potential impacts to designated waterways in the Project area.

Potential impacts to the designated waterways have been minimized during preliminary pole spotting by placing structures such that they would not be immediately adjacent to the majority of these designated waterways. If a route is approved, during final design additional attention will be given to avoiding structure spotting adjacent to these waterways.

6.4.5.1 Outstanding or Exceptional Resource Waters

The following waterways intersecting the proposed ROW of the Preferred Route are designated as an Outstanding Resource Water (ORW) or Exceptional Resource Waters (ERW) and listed with its Project feature ID:

- Gordon Creek (ERW) (S-R23, S-R25);
- Deer Creek (ERW) (S-R32);
- Fryes Feeder (ERW) (S-R33);
- Schalpbach Creek (ERW) (T-R01a);
- Sugar River (ERW) (T-R02); and
- Black Earth Creek (ORW) (Y-R01, Y-R02, Y-R03, Y-R04, Z-R01, Z-R01a, Z-R01b).

The following waterways intersecting the proposed ROW of the Alternate Route are designated as an ORW or an ERW and listed with its Project feature ID:

- Little Platte River (ERW) (E-R27);
- Galena River (ERW) (G-R03);
- Blue River (ERW) (P-R5);
- Garfoot Creek (ERW) (P-R21a); and
- Black Earth Creek (ORW) (Y-R01, Y-R02, Y-R03, Y-R04, Y-R05).

The following waterways intersecting the proposed ROW of the Other Route Segments are designated as an ORW or an ERW and listed with its Project feature IDs:

- Little Platte River (ERW) (J-R01);
- Schalpbach Creek (ERW) (U-R02); and
- Sugar River (ERW) (U-R03).

6.4.5.2 Trout Streams

The following waterways intersecting the proposed ROW of the Preferred Route are designated as trout streams and listed with its Project feature IDs:

- Austin Branch (D-R22, Class II Trout Stream);
- Platte River (D-R29, D-R30, D-R32, D-R35, D-R36, Class II Trout Stream);
- Martinville Creek (D-R33, Class II Trout Stream);
- Gordon Creek (S-R23, S-R25, Class II Trout Stream);
- West Branch Sugar River (S-R28, Class II Trout Stream);
- Sugar River (T-R02, Class II Trout Stream); and
- Black Earth Creek (Y-R01, Y-R02, Y-R03, Y-R04, Z-R01, Z-R01a, Z-R01b, Class I Trout Stream).

The following waterways intersecting the proposed ROW of the Alternative Route are designated as trout streams and listed with its Project feature IDs:

- Platte River (E-R19, L-R02, Class II Trout Stream);
- Blue River (P-R5, Class II Trout Stream);
- Narveson Creek (P-R12, Class II Trout Stream);
- Otter Creek (P-R15, Class II Trout Stream);
- Lowery Creek (P-R16, Class II Trout Stream);
- West Branch Blue Mounds Creek (P-R17g, Class II Trout Stream);
- East Branch Blue Mounds Creek (P-R17j, Class II Trout Stream);
- Vermont Creek (P-R18a, Class II Trout Stream);
- Garfoot Creek (P-R21a, Class III Trout Stream); and
- Black Earth Creek (Y-R01, Y-R02, Y-R03, Y-R04, Y-R05, Class I Trout Stream).

The following waterways intersecting the proposed ROW of the Other Route Segments are designated as trout streams and listed with its Project feature IDs:

- Martinville Creek (J-R02, Class II Trout Stream);
- Sudan Branch (R-R07, Class II Trout Stream); and
- Sugar River (U-R03, Class II Trout Stream).

6.4.5.3 Wild or Scenic Rivers

Waterways designated as Wild and Scenic Rivers are not present along the Preferred Route, Alternate Route, or the Other Route Segments.

6.5 Rare Species and Natural Communities

6.5.1 Communication with WDNR and USFWS

Pre-application agency consultation with the WDNR and USFWS has been ongoing since August 2012 and April 2012, respectively. Consultation regarding rare species and natural communities has occurred in the form of telephone calls, conference calls, email correspondence, and meetings. Key meetings and conference calls are summarized in the Endangered Resource (ER) Review.

6.5.2 Compliance with WDNR and USFWS Direction

An ER Review has been submitted to the WDNR. Due to confidentiality requirements for Wisconsin Natural Heritage Inventory (NHI) data, a redacted copy of the ER Review is included in **Appendix J, Exhibit 1**.

The Applicants have also submitted a draft biological assessment, addressing potential impacts to federally listed species, to the Rural Utilities Service and cooperating agencies (including USFWS) to support the federal Section 7 Endangered Species Act consultation and Environmental Impact Statement.

Appropriate follow-up actions will be coordinated with USFWS and WDNR through the Section 7 and ER Review processes. The Applicants will continue regular communication with the agencies throughout the application process to follow state and federal endangered resources laws during Project evaluation, planning, and implementation.

6.5.3 Concerns and Potential Impacts to Rare Species

The ER Review summarizes element occurrence records of all state-listed rare species within one mile (two miles for aquatic occurrences) of the Preferred and Alternate Routes. The ER Review also outlines the required follow-up actions necessary to protect threatened and endangered animal species, as well as the recommended follow-up actions to help conserve rare species that are not legally protected or are exempt from protection.

6.5.3.1 Endangered Species Law Required Actions

Table 3 of the ER Review (**Appendix J, Exhibit 1**) summarizes the specific segments along which element occurrence records exist for animal species requiring follow up actions. The required actions vary by animal group, and will be implemented by species where threatened and endangered animals are verified to occur based on species surveys or where species are assumed to occur based on the presence of suitable habitat along the identified segments. In general, the actions include completing species surveys or specific host plant surveys in areas of suitable habitat; implementing time-of-year avoidance periods; installing and maintaining exclusion fencing; avoiding work below the OHWM of waterways; implementing erosion/runoff prevention measures; consulting with the WDNR's Bureau of Natural Heritage Conservation (BNHC) if a protected species is verified or assumed to be present; and, if necessary altering the Project where a protected species is verified to be present.

Through the ER Review process, the Applicants will coordinate with the WDNR's BNHC on appropriate conservation measures for each species. If the Project cannot completely avoid impacts to all areas of suitable habitat or take, the Applicants will work with the WDNR's BNHC Incidental Take Coordinator to apply for an Incidental Take Permit for the affected species.

6.5.3.2 Voluntary Conservation Actions

Rare species that are not legally protected or are exempt from protection by the Project include special concern animal species; threatened and endangered, and special concern plant species; and natural communities. Table 3 of the ER Review (**Appendix J, Exhibit 1**) summarizes the specific segments along which element occurrence records exist. In consultation with the WDNR's BNHC, the Applicants will implement recommended avoidance and impact minimization measures when and where practicable in areas where these species or their habitat are verified to occur.

Recommended measures to protect special concern animal and plant species when and where practicable include: voluntary species surveys and/or specific host-plant surveys, adherence to avoidance periods, use of exclusion fencing, use of erosion/runoff prevention practices, and use of on-site biological monitors.

6.6 Invasive Species

6.6.1 Invasive Species/Disease-Causing Organisms

Where accessible, the ROW was evaluated for invasive plant species during field visits along the corridors in the growing season of 2017. (Refer **to Section 5.4** for a discussion of segments evaluated in the field during this time). The general location and composition of dominant invasive species present within the ROW were identified and recorded during wetland delineations and vegetation mapping evaluations; however, this assessment did not include targeted surveys to identify all invasive species.

Invasive plant species were commonly observed along the segments evaluated in the field. Overall, 25 invasive plant species were noted along both routes, all but one falling into the "Restricted" category of Wis. Admin. Code Chapter NR 40. The observed "Restricted" species include:

- Garlic mustard (*Alliaria petiolata*);
- Japanese barberry (*Berberis thunbergii*);
- Spiny plumeless thistle (*Carduus acanthoides*);
- Oriental bittersweet (*Celastrus orbiculatus*);
- Spotted knapweed (*Centaurea maculosa*);
- Canada thistle (*Cirsium arvense*);
- Poison hemlock (*Conium maculatum*);

- Common teasel (*Dipsacus sylvestris*);
- Crown vetch (*Securigaria varia*);
- Russian olive (*Elaeagnus angustifolia*);
- Autumn olive (*Elaeagnus umbellata*);
- Leafy spurge (*Euphorbia esula*);
- Dame's rocket (*Hesperis matronalis*);
- Bell's honeysuckle (*Lonicera* x *bella*);
- Amur honeysuckle (*Lonicera mackii*);
- Tartarian honeysuckle (*Lonicera tatarica*);
- White mulberry (*Morus alba*);
- Wild parsnip (*Pastinaca sativa*);
- Curly-leaf pondweed (*Potamogeton crispus*);
- Common buckthorn (*Rhamnus cathartica*);
- Black locust (*Robinia pseudoacacia*);
- Multiflora rose (*Rosa multiflora*);
- Japanese hedgeparsley (*Torilis japonica*);
- Narrow-leaved cattail (*Typha angustifolia*); and
- Hybrid cattail (*Typha* x *glauca*).

Eurasian manna grass (*Glyceria maxima*) was the only "Prohibited" species observed, found in a wetland and waterways in Segment Q along the Preferred Route.

The most commonly observed "Restricted" plant species along both routes were honeysuckle (*Lonicera* spp.), common buckthorn, multiflora rose, and wild parsnip.

<u>Preferred Route</u>

Seventeen "Restricted" and one "Prohibited" invasive species are found along the Preferred Route. The following discusses invasive species occurrence along the Preferred Route by general area, from west to east.

The western end of the Preferred Route (Segments A and D) runs along an existing, cleared transmission corridor through a mix of agriculture in the valleys and on ridgelines, with forested lands on steep topography. The most prevalent invasive species are invasive shrubs in the forest understory (honeysuckles and multiflora rose) and wild parsnip, Canada thistle, and garlic mustard in the cleared areas.

The central portion of the Preferred Route (Segments N, Q and S) is mostly located along or near highways where roadside grasslands, pastures, and agriculture are common. Wild parsnip and honeysuckles were the most frequently observed invasive species in this area. Twelve "Restricted" invasive species were found along Segments Q and S, including wild parsnip, crown vetch, and Canada thistle in open areas, and dame's rocket, poison hemlock, and garlic mustard in wetter and forest understory conditions. Honeysuckles (*L. x bella* and *L. maackii*), common buckthorn, multiflora rose, and white mulberry were common in forest understories or shrub lands. Narrow-leaved cattail was observed in a degraded marsh and a few riparian wetlands.

The only “Prohibited” species, Eurasian mannagrass, occurs in Laxey Creek and its riparian wetland (Q-R3 and Q-W5) and in Mineral Point Branch and an associated unnamed tributary (Q-R4 and Q-R5).

In the eastern portion of the Preferred Route (Segments T, V, W, Y, and Z), many of the same invasive species occur as on the western and central portions of the Preferred Route. This portion of the route is a combination of existing cleared transmission corridor and new cross-country routes. Commonly occurring invasive species include honeysuckles, common buckthorn, multiflora rose, wild parsnip, garlic mustard, dame’s rocket, Canada thistle, and white mulberry. Singular occurrences of invasive species include black locust, leafy spurge, autumn olive, and Japanese barberry. Hybrid and narrow-leaved cattails occurred in two wetland locations in this portion of the line. The only aquatic invasive plant observed on the route was curly-leaf pondweed, found in Black Earth Creek on Segment Y (Y-R03, Y-R04, Z-R01a, Z-R01).

<u>Alternate Route</u>

Eighteen “Restricted” invasive species were found along the Alternate Route. No “Prohibited” invasive species were observed. The following discusses invasive species occurrence along the Alternate Route by general area, from west to east.

The western portion of the Alternate Route (portions of Segments A and C, and Segment E) runs along a cleared transmission line corridor. In this portion, forested steep slopes are mixed with agriculture in the valleys and on ridgelines, and the most common invasive species observed were in the forest understory and included multiflora rose and honeysuckles. Further east (Segments I, K, and L and portions of Segments G and H), agriculture is the dominant land use. Invasive species were rarely observed in this area.

The eastern portion of the Alternate Route (Segment P and portions of Segments W and Y) is located along a combination of existing and new corridors, where steep forested areas are interspersed with agriculture. Invasive species were frequently observed in this portion of the Alternate Route, and included wild parsnip, spiny plumeless thistle, and Canada thistle in open areas; garlic mustard in wetter and forest understory conditions; narrow-leaved and hybrid cattail in wetlands and waterways; and honeysuckles, common buckthorn, multiflora rose, Russian olive, and white mulberry in forest understories or shrub lands. Wild parsnip and multiflora rose were the most frequently observed invasive species in this portion of the Alternate Route. Singular occurrences of invasive species included autumn olive, spotted knapweed, crown vetch, dame’s rocket, and Japanese barberry. The only aquatic invasive plant observed on the route was curly-leaf pondweed, found in Black Earth Creek on Segments Y and Z (Y-R03, Y-R04, Y-R05).

<u>Other Route Segments</u>

The invasive species populations along the Other Route Segments are similar to the Preferred and Alternate Routes. Multiflora rose and honeysuckles commonly occur in the shrub layers of forested areas; and wild parsnip, crown vetch, leafy spurge, and Japanese hedge parsley occurring along roadsides and in grassy, open areas.

Disease-causing organisms and aquatic species

Both routes and the Other Route Segments are located within areas where oak wilt (*Ceratocystis fagacearum*) is known to occur. Oak trees (*Quercus* spp.) are present and widely distributed within forested lands along both routes. However, the eastern portion of the Alternate Route (segments P and W) generally has a larger amount of forested cover with a greater prevalence of oaks within those woodlands.

All Wisconsin counties and some tribal lands are now under quarantine for the emerald ash borer (*Agrilus planipennis*) quarantine area. The emerald ash borer has been confirmed in the counties that would be intersected by the Project (Grant, Lafayette, Iowa, and Dane). Ash trees are widely distributed throughout the Project area.

Approximately half of the Project would be located within the gypsy moth (*Lymantria dispar*) quarantine area (Dane and Iowa counties), including the approximate eastern half of both the Preferred and Alternate Routes. Segments not within the quarantine area include Segments A, D, and portions of Segment N on the Preferred Route; Segments C, E, G, and portions of Segment H on the Alternate Route; and Segment B and portions of Segments C, D, E, F, G, J, and R of the Other Route Segment options.

An invasive aquatic plant (curly-leaf pondweed, *Potamogeton crispus*) was noted in Black Earth Creek during field observations, and WDNR aquatic invasive species mapping indicates that Eurasian water milfoil (*Myriophyllum spicatum*) is also present in this waterway.

6.6.2 Methods to Avoid and Minimize the Spread of Invasive Species

<u>Aquatic Invasives</u>

Work below the OHWM of waterways will be avoided to the extent practicable; the most likely activity will be withdrawing water to stabilize excavations.

Where equipment or materials are placed below the OHWM of a waterway, prior to moving construction equipment and material between waterway construction locations, standard inspection and disinfection procedures will be incorporated into construction methods as applicable. (*See* Wis. Admin. Code § NR 329.04(5)).

<u>Terrestrial and Wetland Invasives</u>

BMPs will be implemented to comply with Wis. Admin. Code ch. NR 40 when encountering species listed as “Restricted” or “Prohibited.” Standard BMPs have been developed to prevent and minimize the spread of ch. NR 40 listed species. These BMPs will vary throughout the ROW based on the degree of invasiveness, severity of the current infestation, and susceptibility of non-infested areas to invasion.

Typical BMPs throughout the Project area to prevent and minimize the spread of invasive species include:

- Avoidance through construction timing and alternate access;
- Proper management of construction vehicles and materials (i.e. storage, cleaning);
- Minimizing ground disturbance;
- Placing a barrier between construction vehicles and plants (i.e. construction matting);
- Proper storage and disposal of plant materials;
- Promoting native regeneration; and
- Leaving cut vegetation on site where it is cut (i.e. mowing shrubs).

Additional evaluation will be conducted after a final routing decision is made in this proceeding to further identify invasive species, their locations, and locations where site-specific BMPs are appropriate. Appropriate BMPs will be implemented during construction.

6.7 Archaeological and Historic Resources

6.7.1 Construction Location List

See **Appendix A, Exhibit 1** for a list of each county, town, range, section and ¼, ¼ section in which construction would occur.

6.7.2 Wisconsin Historic Preservation Database Results

An archaeological survey and an above ground (architecture/history) review were completed by Commonwealth Heritage Group, Inc. and Burns & McDonnell. Due to the non-public nature of this information, it has been provided under separate cover to the PSCW's Historic Preservation Officer. These reviews were conducted to identify previously inventoried archaeological, cemetery/burial, or above-ground (architecture/history) sites listed in the Wisconsin Historic Preservation Database (WHPD).

The above ground (architecture/history) review considered an area of potential effects (APE) of 1,000 feet from the centerline of each proposed segment. Of the 53 previously surveyed properties located in the APE, 15 are nonextant, 3 have been determined not eligible for the National Register, and 33 are recommended not eligible for the National Register. Two sites are listed on the National Register of Historic Places, one on Segment Q and one on Segment S (both on the Preferred Route).

The archaeological survey report identified 25 sites within the proposed ROW. There are 7 sites coincident with the Preferred Route, none of which are burial sites. There are 13 sites coincident with the Alternate Route, three of which are burial sites. Six sites, one of which is a burial site, are coincident with Other Route Segments.

6.7.3 General Impact Summary

Archaeological surveys were conducted within existing transmission line and road ROWs. Where the proposed routes cross private property, the report is based on review of the Wisconsin Historic Preservation Database and recommends additional survey for sites not previously reviewed that are coincident with the ordered route in order to fully assess the effects.

On the Preferred Route, six of the seven archaeological sites are either likely to be located outside of the proposed ROW, or work within the ROW is not expected to affect cultural resources.

For the Alternate Route, two sites are likely eligible for the National Register of Historic Places; both are burial sites. The Applicants will attempt to avoid or minimize construction access through these areas. In both cases, the site record only covers a portion of the ROW and therefore it is likely that the Applicants will be able to minimize access through the site boundaries. If indicated by pre-construction surveys, the Applicants will employ an archaeological monitor to oversee ground disturbing construction activities.

One site along the Alternate Route appears to have been destroyed by grading and filling associated with highway construction. For the remainder of the sites on the Alternate Route, work within the ROW will not likely result in effects to cultural resources.

In any area where pre-construction surveys identify cultural resources, the Applicants will first consider opportunities to avoid construction access in those areas. In some cases this would involve restricting access to a specific portion of the ROW, and in others it would require obtaining off-ROW access routes. If those efforts are unavailable, employing an archaeological monitor, construction matting or bridging, alternative vehicles and or tires/treads may be utilized to avoid or minimize impacts.

6.8 Conservation Easements

Conservation land interests, to the extent data was available, were considered in the routing and siting process to inform the selection of proposed route segments while avoiding, to the extent practicable, properties with recorded conservation land interests. For instance, Segment S10B on the Preferred Route and the Other Route Segment S11B were adjusted for the conservation easement held by the Driftless Area Land Conservancy on property owned by The Prairie Enthusiasts. Segment Y01A, common to both the Preferred and Alternate Routes, was adjusted for the conservation easement held by the WDNR on property owned by the Ice Age Park and Trail Foundation Inc.

There are many types of conservation easements and encumbrances that exist today. Some of the conservation easements are held by state and federal agencies, while other conservation land interests are held by private organizations. These land rights are generally not known to the Applicants until the easement acquisition process begins with the landowner of record or are identified during public outreach. The listing in Table 6.8.1 below is preliminary because full title searches are completed after there is an approved route and once the Applicants commence the transmission line easement acquisition process. If additional conservation easements are discovered, the Applicants will work with the landowner to accommodate existing agreements or make them whole if there are additional monetary burdens the landowner has to incur.

To identify possible conservation easements along the proposed Project routes, the Applicants first compiled and reviewed data from available resources. The available conservation easement data was from the National Conservation Easement Database, Protected Areas Database of the United States, The Nature Conservancy Lands, the Wisconsin Department of Natural Resources and the Wisconsin Department of Agriculture Natural Resources Conservation Service Easements. The Applicants then verified this compiled data with public title records to create Table 6.8-1 showing the properties along the proposed routes with conservation easements.

Table 6.8-1 Conservation Easements Identified on Proposed Project Routes

ROUTE	SEGMENT	LANDOWNER	HOLDER AND TYPE OF CONSERVATION EASEMENT	LOCATION
Preferred Route	S13	The Nature Conservancy (Project called TNC Anderson - Barneveld Prairie)	WDNR holds Stewardship Grant and Management Contract for Non-Profit Land Acquisition under the Knowles-Nelson Stewardship Natural Areas Grant Program.	SE1/4 of Section 11 and SW1/4 of Section 12, T6 R5E
Preferred Route	Y06B	Dane County (Project called Natural Heritage Land Trust Sunnyside Seed Farm/Black Earth Creek)	WDNR holds Stewardship Grant and Management Contract for Non-Profit Land Acquisition under the Knowles-Nelson Stewardship Program - Habitat Areas.	S1/2 of Section 7, T7 R8E
Alternate Route	E19	Steven and Kimberly Weber	Mississippi Valley Conservancy Inc. holds a conservation easement under Wisconsin law.	NE1/4 of Section 24, T3 R2W
Alternate Route	P03	Blackhawk Hills, Inc.	DATCP holds Perpetual Conservation Easement under Conservation Reserve Enhancement Program. USDA holds a 15 year Conservation Reserve Program contract, dated 9/30/2004, which runs concurrently with the DATCP easement.	SE1/4 of Section 33, T7 R2E

ROUTE	SEGMENT	LANDOWNER	HOLDER AND TYPE OF CONSERVATION EASEMENT	LOCATION
			WDNR holds a Fish Management Easement.	
Alternate Route	P09	Jon and Judith Urness	WDNR holds Critical Area Stabilization, Flowage, and Wildlife Habitat Easement (under Wis. Stat. sec 144.25).	SW1/4 of Section 11, T7 R6E
Alternate Route	Z01B, Z02	Dane County (Project called Natural Heritage Land Trust Sunnyside Seed Farm/Black Earth Creek)	WDNR holds Stewardship Grant and Management Contract for Non-Profit Land Acquisition under the Knowles-Nelson Stewardship Program - Habitat Areas.	S1/2 of Section 7, T7 R8E
Other Route Segments	Z01A	Dane County (Project called Natural Heritage Land Trust Sunnyside Seed Farm/Black Earth Creek)	WDNR holds Stewardship Grant and Management Contract for Non-Profit Land Acquisition under the Knowles-Nelson Stewardship Program - Habitat Areas.	S1/2 of Section 7, T7 R8E

6.9 Restoration

Site restoration, including revegetation where necessary, will be completed as soon as practical and as allowed by seasonal conditions. The need for and approach to site restoration and revegetation will be based on the degree of disturbance caused by construction activities and the ecological setting of each site, and will need to reflect and satisfy the requirements of the property owner. If construction and access in any particular location can be accomplished without creating appreciable soil disturbance, restoration may not require active revegetation efforts.

In cases where there is no sign of re-growth of pre-existing vegetation species in the first month of the subsequent growing season, an assessment will be made and if necessary, an appropriate seed mix, consistent with the surrounding vegetation, will be brought in and properly applied. Where appropriate, based on the surrounding habitat, seed mixes will contain a diversity of flowering species to support pollinator foraging. Restoration of disturbed areas will comply with WDNR-approved technical standards/BMPs.

For the Hill Valley Substation site, a detailed restoration plan will be developed after the Commission’s siting decision is made, and the plan will be submitted to WDNR as part of the

Wisconsin Pollution Discharge Elimination System (WPDES) stormwater discharge permit application. This plan will include the overall site design, including graveled areas, vegetated areas, swales and stormwater ponds.

During active construction and ROW/substation restoration, revegetation and restoration activities will be inspected in accordance with Wis. Admin. Code ch. NR 216 and the WPDES general permit conditions. Written documentation of the inspection will be maintained describing the revegetation progress and corrective measures taken, if applicable. Areas where ground disturbance occurs will be monitored until 70% revegetation has been established.

The invasive species located along the Project ROW and the BMPs to avoid the spread of invasive species are discussed in **Section 6.6**.

7.0 COMMUNITY IMPACTS

7.1 Communication with Potentially Affected Public

Beginning in 2014, the Applicants provided information to and sought feedback from different groups, including landowners, the general public, public officials, and other interested parties in Wisconsin. Throughout the routing and siting process, the Applicants’ representatives actively sought input on Project route alternatives and related issues from state, county and local governments, elected officials, landowners and business leaders.

The Applicants also shared information and obtained input from the public and other interested parties through several forums: conversations at open houses and other meetings; phone calls in response to open house invitations, newsletters, and media coverage; email; and traditional mail. Members of the public and other interested parties consulted included landowners and businesses near corridors; the general public in the study area; non-governmental organizations (e.g. environmental groups, renewable energy advocates, civic groups, economic development groups, and chambers of commerce); and any other party who has expressed an interest in this Project.

<u>Public Open Houses</u>
The Applicants conducted two rounds of public open houses and multiple other meetings for the Project. Approximately 610 people attended the first round of open houses. Approximately 700 people attended the second round of open houses. These numbers do not include those individuals who attended an open house but chose to not register.

In Wisconsin, GIS stations also were available at the 2016 open houses to provide detailed maps of preliminary corridors for landowners and other interested parties. Members of the Applicants’ routing and siting teams, real estate, local relations, government affairs, and project managers also were available at meetings to discuss the Project with interested parties.

In addition, open house meetings introducing the public to the Project and introducing the initial study area were held in October 2014, in the communities of Lancaster, Belmont, Dodgeville, and Middleton. Invitations were sent to landowners within the initial study area whose property was located within one mile of any existing corridor listed as a priority under Wisconsin law. Invitations also were sent to public officials in that same area and anyone the Applicants identified as having a possible interest in the Project. The invitation included an invitation letter, a map of the initial study area and a postage-paid self-mailer comment card for written comments.

A total of 23,474 invitations were mailed for the 2014 open houses. This mailing included the Applicants' phone and email contact information for anyone who was not able to attend the meetings. Anyone receiving an invitation also received a reminder phone call.

An update postcard was mailed in December 2015 with basic Project information and to inform the public of Applicants' plans to host open houses in 2016. This mailing included Applicants' phone and email contact information for anyone who was not able to attend the meetings.

In May 2016, open houses were held in Platteville and Barneveld. There were two consecutive days of open houses in Barneveld, with the east half of the eastern-most area invited one day and the west half of the eastern-most area invited the other day. A total of 4,657 invitations were mailed for the 2016 open houses. This mailing included Applicants' phone and email contact information for anyone who was not able to attend the meetings.

A postal patron newsletter, media articles, and newspaper ads included information about open house dates, times and locations for each round of open houses. A follow-up mailing, including Project information and a map, was mailed to invitees and other registered attendees following each round of open houses. This mailing included Applicants' phone and email contact information for anyone who was not able to attend the meetings.

At the open houses, attendees could provide comments either through written comment cards or entering comments into computer kiosks. Comments also were received through the mail and the Project website. Comments about the Project were entered into the electronic stakeholder-relationship management system, reviewed by the Project team and considered as part of the routing and siting process. These comments also were considered when determining where to narrow the study area and when defining the preliminary corridors.

<u>Stakeholder Outreach</u>
In advance of each of these rounds of open houses, the Applicants took steps to reach out and directly engage local officials (and staff) at local units of government within the Project study area and/or crossed by preliminary corridors, preliminary routes, or proposed routes. These steps included mailings, phone calls, one-on-one meetings, and presentations to local officials and staff, as well as with other stakeholders or potentially affected interests (such as economic development organizations, environmental groups, and business, civic and community groups).

<u>Information Update Mailings</u>
A mailing and corresponding news release were sent in September 2016 sharing revised preliminary corridors that had resulted in changes to the map as part of the federal regulatory review process. This mailing included Applicants' phone and email contact information.

A mailing was sent in June 2017 sharing preliminary routes to those along these routes as well as landowners who were in previously identified revised preliminary corridors.

<u>Potentially Affected Landowner Information Meeting Invitations</u>
Landowners along the Preferred and Alternate Routes and the Other Route Segments were invited via traditional mail to local individual, in-person meetings by appointment in February and March 2018. These meetings were scheduled to allow potentially affected landowners the opportunity for individual meetings specific to their property and to learn more about the regulatory review and real estate processes prior to the filing of the CPCN application with the PSCW. This mailing included a call center phone number and local relations email contact information for anyone who was not able to attend a meeting.

The Project has had a website with Project information and maps since 2014. An interactive map feature was added in 2016.

Copies of public outreach mailings, handouts and advertising are included in **Appendix E, Exhibit 1**.

Written comments were encouraged throughout the outreach process. Written comments were received directly at the open houses as well as through the website, email, letters and other means. Written comments are being provided electronically to the PSCW on a data disc.

7.2 Community Issues

This section identifies some of the more prevalent issues raised by groups and potentially impacted communities. Those issues included concerns related to stray voltage and EMF, Project cost and increased electric rates, environmental impacts, airports and aircraft safety, preservation of natural and scenic beauty, and noise.

Additionally, communities expressed concern about the potential effect of the Project on private and public property including agricultural land, forested areas, wildlife habitats, wetlands, historic and archeological resources, and residential development. Concern was also expressed as to how the Project could affect property values, land rights, tourism, job creation, and the general economy.

Some of the questions raised regarding planning for the Project included whether the need for the Project could be addressed through conservation, distributed generation, dispersed renewable generation, energy related economic development, demand and supply side management, or low-voltage options.

The Applicants conducted public open houses and met with local officials to discuss local concerns, and have regularly spoken to, corresponded with, or met with various stakeholders in response to their inquiries when appropriate. The issues identified above are not necessarily an all-inclusive list; however, it is reflective of most of the concerns that have been brought to the Applicants' attention primarily through comments from stakeholders and resolutions from various municipalities submitted to the Commission and Applicants.

7.3 Land Use Plans

As discussed in **Section 7.1**, the Applicants talked to hundreds of landowners through the public outreach process and met with municipal officials to talk through the impacts on their jurisdictions. The Applicants used the input received on future land use in the routing and siting process, which is described in **Section 5.1**. The existing land use plans in the Project area are provided in **Appendix A, Figure 8.**

7.4 Agriculture

7.4.1 Type of Farming

Agricultural land uses were quantified as part of the impact analysis (**Section 5.4**) and the resulting acreages are provided in the Land Cover table (**Appendix B, Table 2)**.

Property classified as being in agricultural use includes active croplands (row crops, planted hayfields) and specialty agriculture (e.g., tree farms, orchards, cranberry bogs, ginseng). Other agricultural lands such as pastures and fallow fields associated with farm operations were included within the grassland cover types (see **Section 6.2**).

At the western end of the Project, the Preferred and Alternate Routes begin within a mix of agriculture and woodland in a dissected landscape of valleys and ridgelines. The central portion of the Preferred Route passes through a landscape of level to rolling terrain, dominated by agricultural uses. The eastern end of the Preferred Route passes through a largely agricultural landscape in valley bottoms. The central and eastern portions of the Alternate Route cross a predominantly forested landscape, with agriculture confined to valley bottoms.

<u>Preferred Route</u>

The Preferred Route is located within a predominantly agricultural landscape, with approximately forty percent of the proposed ROW in agricultural land use. The majority of the crops are corn and soybeans. However, wheat and alfalfa/hay fields also occur frequently along the segments evaluated in the field. Agricultural lands are widely distributed throughout the Preferred Route.

About one acre of land on a tree farm would be impacted by the Preferred Route, on sub-segment D08. No other specialty crops, such as ginseng, orchards or cranberry bogs, were observed within the proposed ROW along the Preferred Route.

<u>Alternate Route</u>

The Alternate Route is located along a predominantly agricultural landscape along the western extent, with agricultural uses less prevalent along the eastern half. Similar to the Preferred Route, the majority of the crops are corn and soybeans with wheat and alfalfa/hay fields also occurring along the segments evaluated in the field. Agricultural lands are more dominant in the western extent of the Alternate Route.

Approximately 4.4 acres of land on tree farms that would be impacted the Alternate Route. There are 0.5 acres on sub-segment E01 and 3.9 acres on Segment P (sub-segments P02, P03, and P09). No other specialty crops, such as ginseng, orchards or cranberry bogs, were observed within the proposed ROW along the Alternate Route.

Other Route Segments

Agricultural lands along the Other Route Segments are similar to the Preferred and Alternate Routes, with the majority of lands comprised of corn and soybeans, with wheat and alfalfa/hay fields also occurring to a lesser extent.

There is approximately 1.8 acres of land on a tree farm that would be impacted on sub-segment X02. No other specialty crops, such as ginseng, orchards or cranberry bogs, were observed within the proposed ROW on the Other Route Segments.

Hill Valley Substation

The Preferred Substation site and the Other Substation site for the Hill Valley Substation are both in agricultural production, either row crops and/or hayfield.

7.4.2 Agricultural Practices

The following is a review of agricultural practices that may be affected by the Project (construction or operation), such as irrigation systems, aerial seeding or spraying, windbreaks, organic farms, and drainage tiles. The agricultural practices review is based on field observations along accessible routes, aerial photograph review, database queries and review of public comments provided to the Applicants.

No clear evidence of drain tile lines along any route segment was apparent from either aerial photography interpretation or field investigations. However, there are a few areas of farmland along each route that contain hydric soils and are in proximity to ditches, which suggests that drain tiles may exist in these locations. If tiles do exist along the selected route, breakage from construction vehicle travel may occur. Potential mitigation measures for this type of impact are discussed in **Section 7.4.4**.

Center pivot irrigation systems were not observed in the field or on aerial photos. However, if center pivot systems are determined to be affected by placement of the structures, the Applicants will work with landowners to mitigate impacts.

Based on a database obtained from the DATCP in December 2017, there are a number of farms along the proposed routes that utilize organic management practices or are certified organic. There are five reported organic farms along the Preferred Route with two on sub-segment D08, two on Q02, and one on S08. There are seven organic farms along the Alternate Route with four on Segment H (two on both H03 and H06), and three on Segment P (P03, P05, and P08). There is one organic farm reported on the Other Route Segments (S03).

Tree farms were observed along both routes. The project ROW will be cleared, and maintained free of woody vegetation, which will result in a loss of this crop. The landowner will be compensated for this crop loss.

7.4.3 Farmland Preservation Program

Landowners with farmland that is located within an area zoned for farmland preservation can participate in the Farmland Preservation Program (FPP) or landowners located in other zoning districts may have existing FPP agreements with DATCP. DATCP has recently changed their policy and no longer releases a database that lists individual landowners who have voluntarily filed an FPP agreement. Because the Applicants are unable to provide a list of parcels participating in FPP, the Applicants are providing in Table 7.4.3-1 a list of municipalities that have farmland preservation zoning where landowners are be eligible to participate in the FPP.

Table 7.4.3-1 Municipalities with Farmland Preservation Zoning

County	Municipality	Route Segments
Grant	Town of Clifton	Segments D, J and K
Grant	Town of Ellenboro	Segment D
Grant	Town of Harrison	Segment E
Grant	Town of Liberty	Segment D
Grant	Town of Platteville	Segments E, F and G
Grant	Town of Potosi	Segment E
Grant	Town of South Lancaster	Segment D
Grant	Town of Wingville	Segments D, L, N, and R

Electrical transmission lines are permitted on lands enrolled in the Farmland Preservation Program and are considered to be compatible with agricultural use. No landowner has made it known to the Applicants that their land is enrolled in the farmland preservation program. The Applicants will work with all agricultural landowners, as discussed in **Section 7.4.4**, to reduce impacts where practicable.

7.4.4 Minimization of Construction Impacts on Agricultural Lands

Potential construction-related impacts on agriculture will generally be short term in nature, and would primarily consist of crop losses, soil mixing, and/or soil compaction along equipment access routes and around structure installation sites. Short-term impacts would be minimized by providing compensation to producers and by restoring agricultural lands to the extent practicable. Where appropriate, minimization techniques such as topsoil replacement and deep tilling may be utilized.

Long term impacts associated with constructing the transmission line across agricultural lands would be minimized through careful consideration of alignment and individual structure siting. Where possible, siting in agricultural areas will be along fence lines, between fields, or along public road ROW, so the proposed structures are located along the edge of the land area used for agricultural purposes. These routing and siting practices minimize the loss of tillable land and associated interference with agricultural equipment operation. Property owners will be consulted during the real estate acquisition process to accommodate property owner needs to the extent practicable.

In the case of organic farms, landowners will be consulted to minimize potential impacts to their organic farming status due to the transmission line routing or construction. Methods to minimize impacts could include offsetting the transmission line structures from the property line so tree lines or other buffers are maintained. Additionally, construction vehicles may be cleaned prior to entering the organic farm parcels, based on input from the landowner. Further, to protect organic farms during vegetation management activities once the line is in operation, herbicide would not be applied within portions of the ROW on which the landowner wishes not to introduce it.

Each agricultural landowner will be consulted regarding farm operation (e.g. irrigation systems, drainage tiles), locations of farm animals and crops, current farm biological security practices, landowner concerns, and use of access routes. Potential impacts to each farm property along the route will be identified and where practicable, construction impact minimization measures may be implemented. Site-specific practices would vary according to the activities of the landowner/farm operator, the type of agricultural operation, the susceptibility of site-specific soils to compaction, the construction activities occurring on the parcel, and the ability to avoid areas of potential concern.

Drain tiles are common in portions of Wisconsin, and there is no consistent data source to identify them. During the final design process, landowner input would be obtained to place structures such that impacts to drain tiles are minimized, to the extent practicable. During construction, matting may be used to more evenly distribute the weight of heavy equipment and/or low ground impact construction equipment may be used. Post-construction, damaged drain tiles will be repaired to pre-construction conditions.

Where center-pivot irrigation systems are located along portions of the routes on shared ROW (e.g., along roads, transmission lines, and railroads), interference with the system should be minimal. The Applicants will work with landowners to maintain their ability to irrigate their fields, should any transmission line structures be placed in conflict with an existing irrigation system.

7.4.5 Agricultural Impact Statement

An Agricultural Impact Statement (AIS) is generally required when a “project involves the actual or potential exercise of the powers of eminent domain and if any interest in more than 5 acres of any farm operation may be taken.” Wis. Stat. § 32.035(4)(a). As there is the potential that eminent domain may be used to acquire more than five acres of any farm operation, this Project would require an AIS to be prepared. However, since an Environmental Impact Statement (EIS) under Wis. Stat. § 1.11 will be prepared for the proposed Project and the information required in an AIS will be included in the EIS, this Project qualifies for the exception in Wis. Stat. § 32.035(2) and no AIS is required.

The Department of Agriculture, Trade and Consumer Protection (DATCP) has been consulted regarding the necessity for an AIS. An Agricultural Impact Notice for Electric Projects is being submitted concurrent with this Application. Please refer to **Appendix H, Exhibit 5** for a copy of the notification.

7.4.6 Neutral-to-Earth (NEV) and Induced Voltage

The Applicants have identified confined animal dairy operations within one-half mile of the proposed route centerlines, and agricultural buildings within 300 feet of the proposed route centerlines and Other route segments as shown in Appendix A, Figure 6 and summarized in Tables 7.4.6.1-1 through 7.4.6.1-3.

Table 7.4.6.1-1 – Preferred Route

Route Segment	Agricultural Buildings within 300 feet	Dairy Operations within 1/2 mile
Segment A	0	0
Segment D	14	12
Segment L	0	0
Segment N	0	0
Segment Q	117	17
Segment S	45	6
Segment T	12	1
Segment V	15	0
Segment W	5	0
Segment Y	2	0
Segment Z	0	0
Total Preferred	**210**	**36**

Table 7.4.6.1-2 – Alternate Route

Route Segment	Agricultural Buildings within 300 feet	Dairy Operations within 1/2 mile
Segment A	0	0
Segment C	0	0
Segment D	0	0
Segment E	51	10
Segment F	0	3
Segment G	5	5
Segment H	65	3
Segment I	4	1
Segment K	7	1
Segment L	7	0
Segment N	0	0
Segment P	82	9

Route Segment	Agricultural Buildings within 300 feet	Dairy Operations within 1/2 mile
Segment W	5	0
Segment Y	2	0
Total Alternate	**228**	**32**

Table 7.4.6.1-3 – Other Route Segments

Route Segment	Agricultural Buildings within 300 feet	Dairy Operations within 1/2 mile
Segment A	0	0
Segment B	0	0
Segment C	0	0
Segment D	0	0
Segment F	0	0
Segment G	0	1
Segment J	11	1
Segment M	0	0
Segment O	0	0
Segment R	132	22
Segment S	1	3
Segment U	5	0
Segment X	3	0
Segment Z	0	0

Structures and other facilities made of conductive material located in close proximity to electric transmission lines may experience an induced current and voltage due to electric and magnetic field coupling between the facilities. Facilities potentially affected by the proposed Project include railroads and pipelines as well as distribution facilities at multiple segment locations as discussed in **Section 5.3**.

Induction and its potential impacts can be mitigated through implementation of appropriate design measures and techniques, such as:

- Cancellation – The arrangement of transmission line conductors and shield wires to lower electric and magnetic field levels;
- Separation – Increasing the distance between the transmission line and other conductors or conductive objects. Electric and magnetic field levels decrease rapidly with distance; and,
- Grounding of non-energized conductors or conductive objects.

The Applicants will design and construct the proposed facilities to minimize the potential for induction issues. See **Section 5.3** of this Joint Application for locations where electric distribution lines will be relocated to eliminate physical conflicts with the Project or to increase separation with the proposed transmission line. Additionally, the Applicants have identified potentially impacted facilities and will work with the owners to address their concerns. This includes coordinating with the local distribution companies to perform pre- and post-construction testing in accordance with established protocols of potentially impacted facilities to ensure that no adverse impacts result.

7.5 Residential and Urban Areas

Anticipated impacts to residences and the planned mitigation are described below:

Noise

The Applicants' and their contractors will take measures to minimize construction impacts to residential and urban areas where possible. The equipment noise levels of the laydown yards will be consistent with local truck traffic and equipment. The construction noise levels along the Preferred and Alternate Routes, including the substation sites, will be equivalent to highway traffic and truck equipment.

Noise will be intermittent and not out of the ordinary for general truck traffic. Most truck and equipment noise will be from 7:00 am to 6:00 pm, Monday through Friday. Most trucks will leave the designated laydown yards each day during this time.

When undertaking construction activities around residences, the Applicants and their contractors will be cognizant of the residents and will limit work hours in that area, specifically during the early morning hours.

An alternative construction method being evaluated would be limited use of helicopters during construction and/or wire stringing. If helicopters are used on the Project, the Applicants will use various forms of outreach to notify the affected communities and landowners of when the helicopters will be in operation.

Dust

The Applicants and their contractors will be performing drilling operations for the installation of transmission structures and foundations, as necessary; dust impacts will be minimized in the more densely populated residential areas of the Project. In addition, contractors will clean up any dirt or mud that may be tracked onto the road by equipment daily. Tracking pads may be constructed at frequently used access points to minimize mud being tracked onto public roads. Wet sweeping will be used as needed to minimize dust. Traffic control plans will be developed and implemented during construction to minimize traffic impacts and comply with permit requirements. A water truck will be available on-site to spray areas of the laydown yards and ROW that are creating excessive dust.

Duration of Construction

Construction is anticipated to begin in October 2020 and end in late 2023.

Time-of-Day Construction

The Applicants and their contractors plan to generally work during daylight hours Monday through Friday; therefore, the workday will vary slightly depending upon the time of year, access constraints and weather conditions. During winter, contractors will work shorter days and during summer they will work longer days with an average work day to be approximately 11 hours. In addition, there may be times when contractors are required to perform work on weekends or at night due to electric system or access constraint requirements.

Road Congestion

Construction vehicles will use public roads to access the ROW. There may be occasions when construction vehicles are parked on roads during construction. The Applicants will minimize the number of vehicles and the amount of time they are parked on the roads. All current traffic control measures will be adhered to while equipment is on a public roadway.

Impacts to Driveways

The Applicants and their contractors anticipate using driveways for equipment parking or travel only where specific landowner permissions are received. For the purpose of completing construction, the Applicants and their contractors do not anticipate requiring the use of driveways for structure access near residences. If a driveway is needed to access the ROW, the driveways may be protected using composite mats or other low-profile protection systems. Commercial or industrial driveways will be evaluated prior to use as surface protection may not be required. Any damage caused by construction access will be repaired as needed. In addition, the Applicants and their contractors will not block any residence driveways with equipment unless agreed upon with the landowner or resident.

7.6 Aesthetic Impacts

7.6.1 Simulations

Photo simulations were developed by the Applicants in the southwest portion of the Project area at the request of the USDA Rural Utilities Service in the Upper Mississippi National Wildlife Refuge near the Mississippi River crossings being evaluated at the Stoneman and Nelson Dewey locations. These simulations are included in **Appendix I, Exhibit 1**.

Photo simulations were also developed by the Applicants in the northeastern portion of the Project area at the request of the National Park Service. The National Park Service manages the Cross Plains Unit of the Ice Age National Scientific Reserve. The simulations are included as **Appendix I, Exhibit 2**.

7.6.2 Scenic Roads

The Preferred Route (segment A02) and Alternate Route (segments B02, E02) cross STH 131 near Cassville. STH 131 is designated the Great River Road, a Wisconsin scenic byway in this area.

7.7 Parks and Recreation Areas

Parks, recreation areas, and trails that may be impacted by the Project represent a subset of the public properties listed in Table 6 and discussed in **Section 5.4**. A discussion of the relevant properties is provided below, by route.

Preferred Route

As listed in Table 7.7-1, the Preferred Route would affect five park and recreational areas.

Table 7.7-1. List of Parks, Recreation Areas and Trails Affected by the Preferred Route

Segment	Property Name	Owner/Manager	Description
Q02	Village Park	Village of Cobb	Segment is located along an existing transmission line ROW along the northern property boundary of the Village Park
S01	Military Ridge Trail	State of Wisconsin Department of Natural Resources	Segment runs parallel to the trail adjacent to USH 151
T01	Military Ridge Trail	State of Wisconsin Department of Natural Resources	Segment crosses the trail east of Mount Horeb
Z01B/Z02	Black Earth Creek Wildlife Area - Sunnyside Unit	Dane County Parks	Segments are located adjacent to USH 14 within the Wildlife Area

Alternate Route

As indicated in Table 7.7-2, the Alternate Route would affect 6 park and recreational areas.

Table 7.7-2. List of Parks, Recreation Areas and Trails Affected by Alternate Route

Segment	Property Name	Owner/Manager	Description
H01	Pecatonica State Trail	State of Wisconsin Department of Natural Resources	Segment crosses the trail east of Platteville
P01	Village trail / property	Village of Montfort	Segment is adjacent to a trail located along a former railbed
P02	Cobb-Highland Commission	Cobb-Highland Commission	Segment is located along an existing transmission line that crosses this property, which is adjacent to the Blackhawk Lake Recreation Area
P02	Blackhawk Lake Recreation Area	State of Wisconsin Department of Natural Resources	Segment is located along an existing transmission line that crosses the Blackhawk Lake Recreation Area
Y06B	Black Earth Creek Wildlife Area - Sunnyside Unit	Dane County Parks	Segment is located along an existing transmission line that crosses the Wildlife Area

<u>Other Route Segments</u>

As indicated in Table 7.7-3, the Other Route Segments would affect three park and recreational areas.

Table 7.7-3 List of Parks, Recreation Areas and Trails Affected by Other Route Segments

Segment	Property Name	Owner/Manager	Description
S11D	Military Ridge Trail	State of Wisconsin Department of Natural Resources	Segment runs parallel to the trail adjacent to USH 151
U02	Military Ridge Trail	State of Wisconsin Department of Natural Resources	Segment crosses the trail
Z01A	Black Earth Creek Wildlife Area – Sunnyside Unit	Dane County Parks	Segment is located adjacent to USH 14 within the Wildlife Area

Potential long-term impacts on the affected properties have been reduced through the selection of route segments that share existing corridors.

The Applicants intend to work with the land managers to coordinate the timing of construction to minimize impacts to park and recreational area users. To ensure public safety, portions of these areas may need to be closed temporarily during construction. The Applicants intend to minimize the area and duration of closures as much as possible and work with the land managers to communicate any necessary closures to park and recreational area users.

7.8 Airports

7.8.1 Location of Private and Public Airstrips

The Applicants identified twelve public and private use airports and heliports within four miles of the proposed route centerlines. A list of the airports and heliports and their corresponding locations are provided in Table 7.8.1-1 below.

Table 7.8.1-1 – Airport Information

Segment	Airport Name	Distance from Centerline	Type Airport / Use	City
B	Cassville Muni – C74	1.0 Miles	Airport / Public	Cassville
D	Lancaster Muni – 73C	3.1 Miles	Airport / Public	Lancaster
G	Platteville Muni – PVB	1.6 Miles	Airport / Public	Platteville
R	Iowa County – MRJ	3.5 Miles	Airport / Public	Mineral Point
P	Southwind – 22WN	1.9 Miles	Airport / Private	Dodgeville
P	Forseth Field – WI61	0.4 Miles	Airport / Private	Arena
P	Hallick Farm – WI66	0.4 Miles	Airport-Heliport / Private	Black Earth
R	Memorial Hospital – WI44	0.4 Miles	Heliport / Private	Dodgeville
S	Atkins Ridge – WI43	4.0 Miles	Airport / Private	Daleyville
S	Docken Field – 37WI	0.4 Miles	Airport / Private	Mount Horeb
U	Hecklers' Strip – 2WI7	2.5 Miles	Airport / Private	Mount Vernon
Y	Middleton Muni – Morey Field - C29	2.4 Miles	Airport / Public	Middleton

7.8.2 Description of Airports/Airstrips and 7.8.3 Impacts to Aircraft Safety and Navigable Airspace

Under the provisions of 14 C.F.R. Part 77 (Part 77), the Federal Aviation Administration's (FAA) objective is to ensure safe and efficient use of the navigable airspace for public use and military airports and heliports (facilities). To accomplish their objective, the FAA conducts aeronautical studies of proposed and existing structures provided to the FAA in Form 7460-1, Notice of Proposed Construction or Alteration (Notice). The criteria for filing a notice are defined in § 77.9. Part 77 does not typically apply to private use facilities, with the exception of those that have FAA approved plans or procedures. Wisconsin does not require specific clearance surfaces. Nevertheless, the Applicants used the same imaginary surface requirements that the FAA enforces on public use airports when evaluating the proposed route corridors and potential impacts to private use facilities within ½ mile of a proposed route segments. This is a conservative approach with respect to clearance requirements for these non-public airstrips. Also, any private use facility that was greater than ½ mile from a proposed route segment, but did potentially have structure height concerns with a horizontal, conical, or approach surface, as defined by the FAA, was evaluated and is discussed below.

The Cassville Muni (C74) airport is a public use airport near Cassville, Wisconsin. The latitude/longitude of the airstrip is 42.7043 N/90.9661 W at an elevation of 627 feet. There is one runway (11/29) with an asphalt surface that is 3000 feet in length and runs in a northwest/southeast alignment. This airport is less than 1.0 mile from Segment B. Based on this distance, notice to the FAA would likely be required for multiple structures. It is also likely that structure heights would be limited by one or more Part 77 obstruction surfaces that apply to this facility. Once the final route is selected, notice will be provided to the FAA for all structures that exceed notice criteria and the conditions of the FAA determinations will be observed. This could include lowering structure heights or marking and lighting one or more transmission structures and their wire spans.

The Lancaster Muni (73C) airport is a public use airport near Lancaster, Wisconsin. The latitude/longitude of the airstrip is 42.7825 N/90.6811 W at an elevation of 1015 feet. There is one runway (18/36) with an asphalt surface that is 3300 feet in length and runs in a north/south alignment. This airport is approximately 2.8 miles south of Segment D and approximately 4.0 miles north of Segment E. Based on these distances, notice to the FAA may be required for some of the closer structures, but it is unlikely that structure heights would be limited by one of the Part 77 obstruction surfaces that apply to this facility. Once the final route is selected, notice will be provided to the FAA for all structures that exceed notice criteria for this airport, and the conditions of the FAA determinations will be observed. As noted above, this could include lowering structure heights or marking and lighting one or more transmission structures and their wire spans. Airport height limitation zoning restrictions for the Lancaster Municipal airport are shown in Appendix A, Figure 11.

The Platteville Muni (PVB) airport is a publicly owned airport near Platteville, Wisconsin. There are two runways at Platteville Muni. The latitude/longitude of the first runway (07/25) is 42.6876 N/90.4450 W at an elevation of 1022 feet with an asphalt surface that is 3599 feet in length and runs in a southwest/northeast alignment. The latitude/longitude of the second runway (15/33) is 42.6909 N/90.4439 W at an elevation of 1022 feet with an asphalt surface that is 3999 feet in length and runs in a northwest/southeast alignment. The threshold of one of these runways is approximately 1.2 miles from Segment G. Based on this distance, notice to the FAA will likely be required for multiple structures near Platteville Muni. A preliminary review of this airport indicates that structure heights could be limited to less than 150-foot above ground level by one or more instrument approach obstruction surfaces that apply to this runway. Once the final route is selected, notice will be provided to the FAA for all structures that exceed notice criteria and the conditions of the FAA determinations will be observed. This could include lowering structure heights or marking and lighting one or more transmission structures and their wire spans. Airport height limitation zoning restrictions for the Platteville Municipal Airport are shown in Appendix A, Figure 10.

The Iowa County (MRJ) airport is a publicly owned airport near Mineral Point, Wisconsin. There are two runways at Iowa County. The latitude/longitude of the first runway (04/22) is 42.8853 N/90.2320 W at an elevation of 1171 feet with an asphalt surface that is 3600 feet in length and runs in a southwest/northeast alignment. The latitude/longitude of the second runway (11/29) is 42.8880 N/90.2400 W at an elevation of 1164 feet with an asphalt surface that is 5001 feet in length and runs in a northwest/southeast alignment. This airport is approximately 3.5 miles from Segment R. Preliminary structure locations and heights were filed with the FAA. The FAA issued determinations of no hazard for all preliminary structure locations that were required to be filed for this airport.

The Southwind (22WN) airport is a privately-owned airport near Dodgeville, Wisconsin. The latitude/longitude of the airstrip is 43.0686 N/90.2195 W at an elevation of 1030 feet. There is one runway (11/29) with a turf surface that is 1800 feet in length and runs in a northwest/southeast alignment. This airport is approximately 1.9 miles from Segment P. The proposed alignment does not impact the FAA imaginary surfaces.

The Forseth Field (WI61) airport is a privately-owned airport near Arena, Wisconsin. The latitude/longitude of the airstrip is 43.0916 N/89.9980 W at an elevation of 800 feet. There is one runway (10/28) with a turf surface that is 2500 feet in length and runs in an east/west alignment. This airport is approximately 0.4 miles from Segment P. The proposed alignment does show a possible issue with FAA imaginary surface requirements. If this segment is ordered, the Applicants would coordinate with the appropriate local officials, Wisconsin Bureau of Aeronautics and the airport operator to mitigate any conflicts.

The Hallick Farm (WI66) airport is a privately-owned airport near Black Earth, Wisconsin. There is one helipad and one runway at Hallick Farm. The latitude/longitude of the runway (15/33) is 43.0994 N/89.7764 W at an elevation of 1097 feet with a turf surface that is 1550 feet in length and runs in a northwest/southeast alignment. The helipad has a concrete surface at an elevation of 1097 feet and is 40 feet by 40 feet. This airport is approximately 0.4 miles from Segment P. The proposed alignment does show a possible issue with FAA imaginary surface requirements in relation to the runway. If this segment is ordered, the Applicants would coordinate with the appropriate local officials, Wisconsin Bureau of Aeronautics and the airport operator to mitigate any conflicts.

The Upland Hills Health (WI44) heliport is a privately-owned heliport near Dodgeville, Wisconsin. The latitude/longitude of the helipad is 42.9519 N/90.1285 W. The helipad has an asphalt surface at an elevation of 1213 and is 39 feet by 39 feet. The helipad is approximately 0.4 miles from Segment R. The proposed alignment does not impact the FAA imaginary surfaces.

The Atkins Ridge (WI43) airport is a privately-owned airport near Daleyville, Wisconsin. The latitude/longitude of the airstrip is 42.9489 N/89.8253 W at an elevation of 1090 feet. There is one runway (18/36) with a turf surface that is 2400 feet in length and runs in a north/south alignment. This airport is approximately 4.0 miles from Segment S. The proposed alignment does not impact the FAA imaginary surfaces.

The Docken Field (37WI) airport is a privately-owned airport near Mount Horeb, Wisconsin. The latitude/longitude of the airstrip is 42.9911 N/89.7535 W at an elevation of 1230 feet. There is one runway with a turf surface (15/33) that is 1800 feet in length and runs in a northwest/southeast alignment. This airport is approximately 0.4 miles from Segment S. The proposed alignment may have a possible issue with FAA imaginary surfaces. Based on aerial imagery this runway appears to have fallen out of use but is still on file with the FAA. If this segment is ordered, the Applicants would coordinate with the appropriate local officials, Wisconsin Bureau of Aeronautics and the airport operator to mitigate any conflicts.

The Hecklers' Strip (2WI7) airport is a privately-owned airport near Mount Vernon, Wisconsin. The latitude/longitude of the airstrip is 42.9697 N/89.6654 W at an elevation of 1130 feet. There is one runway (04/22) with a turf surface that is 2114 feet in length and runs in a southwest/northeast alignment. This airport is approximately 2.5 miles from Segment U. The proposed alignment does not impact the FAA imaginary surfaces.

The Middleton Muni- Morey Field (C29) airport is a publicly owned airport near Middleton, Wisconsin. There are two runways at Morey Field. The latitude/longitude of the first runway (01/19) is 43.1149 N/89.5281 W at an elevation of 928 feet with a turf surface that is 2000 feet in length and runs in a north/south alignment. The latitude/longitude of the second runway (10/28) is 43.1139 N/89.5333 W at an elevation of 928 feet with an asphalt surface that is 4000 feet in length and runs in an east/west alignment. This airport is approximately 2.4 miles from Segment Y. Airport height limitation zoning restrictions for Morey Field are shown in Appendix A, Figure 10. Preliminary structure locations and heights were filed with the FAA. The FAA issued determinations of no hazard for all preliminary structure locations that were required to be filed for this airport.

7.8.3 Potential Construction Limitations and Permit Issues

The Project is governed by Wis. Stat. §§ 196.491(3)(i) and 196.491(4)(c). Where structure heights meet FAA requirements but would otherwise be further restricted by height limitation zoning ordinances, the Applicants are not subject to those zoning ordinances but will work with the impacted local units of government to reasonably address their concerns.

7.8.4 FAA Documentation

Mississippi River to Hill Valley

For the Mississippi River to Hill Valley portion of the Project, an internal evaluation of the Preferred and Alternate Route was undertaken. The goal of this evaluation was to identify areas where notice to the FAA would be likely, and where potential airspace obstruction issues could occur. The size and function of an airport, the relationship of the proposed structure to the runway centerline, and the difference in elevation between the structure site and the airport all factor into this evaluation. The FAA Notice Criteria Tool ("notice tool") was also used to determine structures that require notice to support the overall evaluation. The notice tool evaluates structures based on the location, elevation, and height data that is entered, and informs the user if the FAA requests does or does not request notice.

For the Preferred Route, the only airport identified with the potential to create the need to file notice or have obstruction surfaces that could affect the Preferred Route was the Lancaster Municipal Airport. Based on the evaluation for the Preferred Route, a small section of structures on the Preferred Route would require notice to the FAA. However, none of these structures are expected to exceed any of the FAA obstruction standards or be determined a hazard by the FAA.

The structures that require notice, as identified by the notice tool, are located approximately 15,000 feet from the nearest runway end. They exceed a notice surface that extends outward from the runway edge for 20,000 feet at a slope of 100:1 (horizontal feet to vertical feet) as defined by the FAA in 14 CFR Part 77.9. The civil airport imaginary surfaces that the FAA applies to identify potential obstructions or hazards (obstruction identification surfaces) are based on the size and operations of the airport as defined by the FAA in 14 CFR Part 77.19. The obstruction identification surfaces that apply to the Lancaster Municipal Airport extend out a total of 9,000 feet from the runway edge, and the Proposed Route does not cross any of these surfaces. Furthermore, there are no published instrument procedures to this airport which can have obstruction identification surfaces that could affect a structure at 15,000 feet or more from the runway.

Based on the evaluation factors assessed for this route, no other sections along the Preferred Route were identified that would require notice. Therefore, no part of the Preferred Route is expected to exceed obstruction standards or be determined a hazard to air navigation. In using the notice tool, the Applicants inserted preliminary structure heights and locations, plus an additional amount of height to account for potential inaccuracies in the elevation and location information. For those structures requiring notice, the Applicants submitted form 7460-1 to the FAA for their review. Once a route is ordered and detailed design is completed, any additional structures requiring notice to the FAA will be filed.

The internal evaluation identified two areas of where notice was required due to airports located along the Alternate Route. The Applicants filed notice for several preliminary structure locations along the Alternate Route and the FAA issued a Notice of Presumed Hazard (NPH) letter for four structures near the Cassville Municipal Airport and sixteen structures near the Platteville Municipal Airport. The NPH letters provide the initial findings of the FAA study and contain recommendations for resolving the presumed hazard. The NPH letters are provided in **Appendix H, Exhibit 3**. In many cases, the Applicant can ask the FAA to conduct further study on these structures, requesting that they consider factors, such as terrain and existing obstructions that were not considered in the initial study. If the Alternate Route is ordered for this Project a new notice will be filed for these structures and all other structures that require notice, based on the final design details.

<u>Hill Valley to Cardinal</u>

For all routes from the Hill Valley Substation to the Cardinal Substation, the Applicants used the FAA Notice Criteria Tool to determine which structures in the Project would require filing with the FAA. The Applicants input structure heights and locations from the preliminary design, plus an additional amount of height to account for potential inaccuracies in the elevation and location information. For those structures requiring filing with the FAA, the Applicants submitted form 7460-1 “Notice of Proposed Construction or Alteration” to the FAA for review. The FAA preliminary determinations showed that obstruction standards are not exceeded based on the preliminary structure locations and structure heights, and would not be a hazard to air navigation to the public airports. All preliminary determinations from the FAA are provided in **Appendix H, Exhibit 3**. Once a route is ordered and detailed design is completed, any structures requiring notice to the FAA will be refiled.

7.9 Communication Towers

In order to determine the types of communication towers adjacent to the proposed Project segments, a search of available FCC databases was conducted and all communication towers within a 10 kilometer (km) distance were identified. A location map showing all communication facilities within the 10 kilometer range and accompanying tables, which indicate facility type, owner, location, and distance to the proposed routes, can be found in **Appendix K, Exhibit 1**. The types of facilities that were found within 10 kilometers of the proposed routes were as follows: AM broadcast facilities (AM), FM broadcast facilities (FM), Antenna Support Structures that are greater than 200 feet (ASR), Cellular facilities (CELL), Land Mobile Broadcast facilities (LM Broadcast), Private Land Mobile stations (LM Private), Commercial Land Mobile stations (LM Com), Microwave radio stations (MW) and Wireless Internet Service Providers (WISP).

The type of communication tower/facility use determines the type of interference that might be encountered with the construction of a high-voltage transmission line. Based on the types of communication facilities found within 10 kilometers of the proposed transmission line routes, the following interference types were possible. However, an interference study has been completed and concluded that the following types of interference are not anticipated to be a concern:

Audible Noise and Radio Frequency Interference

Audible noise interference (ANI) due to Corona discharge and radio frequency interference (RFI) typically occur when transmission line hardware is exposed to weather for long periods of time, typically years. Impurities in rain will build calcium deposits on line hardware, which causes radio frequency spark gap emissions. Since line hardware proposed for this transmission line will be newly manufactured using modern production techniques, spark gap emissions are rare and are not expected to occur on the new high-voltage transmission line. However, improperly installed transmission line hardware can generate corona discharge that causes audible noise interference. Fortunately, audible noise interference caused by improperly installed line hardware can be quickly identified using specialized test equipment and corrected immediately after the transmission line segments have been energized.

Microwave Signal Obstruction

Microwave radio antennas emit very narrow signal beams thus requiring clear line-of-sight paths. The paths can be obstructed by transmission line support structures placed within the microwave radio signals' near-field region (Fresnel region) resulting in loss of microwave signal. A review of the microwave radio facilities in the Federal Communications Commission (FCC) database showed that no microwave line-of-sight paths will be obstructed by the proposed transmission line structures. A field review will take place to confirm that there are no microwave line-of-sight path issues during construction. If issues are found, the Applicants will work with the licensee to mitigate the issue.

Transferred Ground System Voltage

Energized high-voltage transmission lines built within 500 feet of an existing communication facility increase the risk of transmission line noise conduction into sensitive communication electronic equipment due to the potential ground difference between the transmission line and communication site ground systems. This condition also increases the risk to human safety if a transmission line to ground fault were to occur. This would be a violation of Occupational Safety and Health Administration (OSHA) grounding system standards. Therefore, detailed ground system design analyses and corrective grounding measures are typically performed prior to line energization to satisfy OSHA grounding standards for all communication tower facilities within 500 feet of the new transmission line. Remedies include modifying OSHA substandard communication tower site ground systems and/or providing additional transmission line ground conductors to balance the impedance between the transmission line and communication tower facility ground systems. Based on the initial FCC database search it was determined that there are multiple communication facilities located within 500 feet of the new proposed high-voltage transmission line. Further testing will be conducted during the construction of the line to satisfy OSHA grounding standards.

AM, FM, CELL, and Facilities

Per the FCC database search there were AM, FM, CELL, WISP facilities found within 10 kilometers of the proposed transmission routes. The Applicants do not anticipate interference of these facilities with the proposed transmission line route options.

Typically, AM facilities have the potential for interference from transmission lines, such as distortion of the AM antenna radiation pattern. The proposed transmission line facilities satisfy the FCC separation and height requirements to prevent AM coverage pattern distortion for the two AM facilities located within the Project area.

FM facilities are only transmitters (not receivers), therefore the FM facilities that are found within the Project area are not susceptible to radio frequency interference of any type.

Due to the ultra-high frequency bands that cellular services operate in, they do not have the potential of radio frequency interference from the installation of a transmission line.

WISP are not susceptible to transmission line noise due to their extremely high frequency (GHz) operation and complex modulation schemes.

7.10 Community Income from High-Voltage Transmission Impact Fees

There are two types of community income from high-voltage transmission impact fees required under Wis. Stat. § 196.491(3g) for transmission lines designed for operation at 345 kV or more: a one-time environmental impact fee and an annual impact fee. The estimated impact fees for each route alternative are provided in Table 7.10.1-1 below. Costs are based on the projected in-service year (2023). The Applicants expect to each pay a portion of the impact fee equal to their ownership share, as presented in **Section 1.1**, in the Project.

Table 7.10.1-1 High Voltage Transmission Impact Fees

Cost Category	Proposed Routes	
	Preferred	**Alternate**
T-Line High Voltage Cost	$ 247,951,000	$ 271,294,000
Substation Cost	$ 33,693,000	$ 33,693,000
Total High-Voltage Cost	$ 281,644,000	$ 304,987,000
One-time (5%) Environmental Impact Fee	$ 14,082,200	$ 15,249,350
Annual (0.3%) Impact Fee	$ 844,932	$ 914,961

In accordance with previous Commission rulings under Wis. Stat. § 196.491(3)(gm), the Applicants considered the cost of the 345 kV transmission line and the 345 kV and lower voltage substation components when calculating these impact fees. Excluded from the high-voltage costs are costs associated with: the construction of lower voltage transmission lines and distribution lines; operations and maintenance; pre-certification expenses; costs incurred by ITC Midwest and Dairyland prior to receiving an Order if approved; AFUDC; and the high-voltage impact fees themselves. Additionally, the high-voltage cost estimates do not have any allowance for risk, which is included in the Project cost estimates. Costs for facilities in Iowa were also excluded.

Estimates of the one-time environmental and annual high-voltage impact fee payments to each affected city, village, town and county for the Preferred and Alternate Routes are provided in Appendix L, Tables 1 and 2. If actual Project costs vary from the high-voltage cost estimates shown in Table 7.10.1-1 above, due to realization of risk or cost savings, adjustment (true up) of the fees will occur in accordance with Wis. Admin. Code §§ Adm. 46.04(2) and 46.05(2).

8.0 WDNR PERMITS AND APPROVALS

A WDNR Utility Permit is anticipated to be required for this Project. The WDNR permits required for construction of the proposed facilities include:

- Chapter 30 Permit to place temporary bridges in or adjacent to navigable waters, pursuant to Wis. Stat. § 30.123 and Wis. Admin. Code ch. 320;
- Chapter 30 permit for grading on the bank of a navigable waterway, pursuant to Wis. Stat. § 30.19 and Wis. Admin. Code ch. 341;
- Wetland Individual Permit, pursuant to Wis. Stat. § 281.36 and Wis. Admin. Code chs. NR 103 and 299;
- WPDES Storm Water Discharge Permit pursuant to Wis. Stat. ch. 283 and Wis. Admin. Code ch. NR 216;
- Incidental Take Authorization pursuant to Wis. Stat. ch. 29.604 if the Utilities are unable to avoid impacts to state listed species, as identified through consultation with WDNR; and
- Any other applicable permit which is required, if the need for that permit is identified by WDNR.

Throughout the Project pre-application phase, the Applicants engaged with both WDNR and PSCW staff in the consultation process as described in Wis. Stat. § 30.025(1m). By participating in the consultation process the Applicants were able to share information regarding the proposed project, receive and incorporate feedback on potential and proposed route segments, and develop application materials for the Utility Permit that would contain all of the data identified as being required by PSCW and WDNR to review and permit the proposed project.

Documentation required by the WDNR for evaluating applications for the permits described above (not including NR 216 and Incidental Take Authorization) is provided in this Application. A Notice of Intent under NR 216 would be filed after a route and substation site are ordered, and prior to construction of the Project. An application for Incidental Take Authorization will be submitted if WDNR finds that a take of a given species is unavoidable.

Temporary Bridges

Temporary bridge crossings will be required at navigable waterways as described in Section 6.4, listed in **Appendix F, WDNR Table 1**, and shown on **Appendix A, Figures 4A, 4B and 4C**. These crossings require approval by the WDNR under Wis. Stat. § 30.123. All of the waterways are less than 35-feet wide. All bridge crossings less than 35 feet wide are designed to meet the standards and conditions for temporary clear span bridge crossings in Wis. Admin. Code § NR 320.06. A clearance waiver, as authorized by Wis. Admin. Code § NR 320.04(3), will be requested once a route is ordered for those crossings that do not meet the clearance standard in Wis. Admin. Code § NR 320.04.

Approximate channel dimensions are detailed for each proposed bridge crossing location (where access was available) in **Appendix F, WDNR Table 2** for each route, and photographs are provided in the wetland delineation report for those waterways observed in the field. The wetland delineation report is being provided separately, concurrent with this application. A detailed drawing for a typical TCSB is provided in **Appendix F, Figure 1**.

Grading on the Banks

Grading in excess of 10,000 ft^2 is anticipated at one location listed in **Appendix F, WDNR Table 1**, which would require approval under Wis. Stat. § 30.19.

Discharges to Wetlands

Transmission structures to be placed in wetlands are summarized in Section 6.3. The proposed locations are specified and enumerated in **Appendix F, WDNR Table 1** for each route, and the wetlands are shown on **Appendix A, Figures 4A, 4B and 4C**. Placement of fill in wetlands, including the temporary fill resulting from protective matting placement, may require approval under Section 404 of the Clean Water Act (CWA) from the ACOE; water quality certification from the WDNR under Section 401 of the CWA, Wis. Stat. §§ 281.15, 281.31 and 281.36, and Wis. Admin. Code ch. NR 299.

8.1 WDNR Tables for Wetlands and Waterways

A WDNR Waterway / Wetland Impact Location Table (**Appendix F, WDNR Table 1**) and an Environmental Inventory Table (**Appendix F, WDNR Table 2**) are provided for each route and Other Route Segment. In addition to wetlands and waterways encountered along the routes, the Environmental Inventory Table also includes upland natural communities that are referenced in other sections of this Application (i.e., Section 6.1 – Forested Lands, 6.2 – Grasslands, and Sections 6.6 and 9.0 which are related to Endangered Resources and Natural Communities).

8.2 Wetland Practicable Alternatives Analysis

The following subsections summarize the Wetland Practical Alternatives Analysis for the Project.

8.2.1 Corridor and Route Selection Process

Wetlands were factored into the Project corridor and route selection process from the outset. A data layer indicating the location of wetlands within the Project area, as mapped by the Wisconsin Wetland Inventory (WWI), was an integral component of the GIS mapping that was continually referenced as the number of potential corridors was narrowed down and route segments were defined and culled by the Project team. During each planning phase, potential wetland impacts were taken into consideration along with other environmental and social impacts, input from the preceding open houses, engineering feasibility, and cost. These factors were evaluated along every line segment that could potentially be used to route a transmission line between the Cardinal Substation and the Hickory Creek Substation, as described in **Section 5.1**.

Two route alternatives (including short common segments and some Other Route Segments) were identified for further evaluation and refinement. Segments comprising these routes are detailed in Section 5.4. Proposed alignments along these routes were chosen based on a number of factors including landowner input, engineering design criteria, impacts to residences, and impacts to environmental features including wetlands, waterways, and forested areas.

8.2.2 Wetland Impact Minimization

All proposed route segments have been selected to avoid and minimize wetland impacts to the extent practicable. However, given the extent of wetlands in the Project Area and structure spanning requirements, wetland impacts cannot be completely avoided by either route. Structure locations are dependent upon several factors, including topography and ROW constraints. In combination, these factors can restrict the Applicants' flexibility to completely avoid structure placement in wetlands. Generally, structures are spotted to not locate poles within 50 to 75 feet of streams, creeks, or rivers, and, outside of wetlands if possible. In addition, many route segments occur along existing corridors, which minimizes wetland impacts associated with this Project.

The number of transmission structures preliminarily determined to be placed in wetlands represents a conservative estimate based on the conceptual structure locations, as discussed in Section 6.3, and is further detailed by wetland in Section 8.1 (**Appendix F, WDNR Table 1**).

Upon route approval, as discussed in Sections 6.3.3 and 6.3.4, the Applicants will attempt to further avoid and minimize wetland impacts while engineering the final structure locations. For example, where possible, efforts will be made to locate structures outside of wetlands. However, based on the number and extent of wetlands along each route, complete avoidance of wetlands is not likely.

As discussed in Sections 6.3.3 and 6.3.4, the use of heavy equipment in wetlands will also be minimized to the extent practicable. For example, if construction occurs during periods when the ground is not frozen, dry, or otherwise stable, low ground pressure vehicles and/or construction matting will be used. The Applicants will also attempt to identify off-ROW access routes that minimize access through wetlands, as described in Section 5.7.

8.2.3 Practicable Alternative Analysis

Sections 2.1 through 2.5 discuss alternatives based on the need for the Project and the alternatives considered.

For the proposed Project, the process for considering alternative route segments is described in Section 8.2.1. As with any linear project that traverses an expansive area of the landscape of Wisconsin, complete avoidance of wetlands is not physically possible due to the frequency of wetland occurrence.

8.2.4 Wetland Impacts

As discussed in Section 6.3.3, a number of proven methods will be employed, during construction, to reduce impacts to those wetlands that will be intersected by the Project alignment. The primary means for wetland impact minimization will be to limit, to the extent practicable, the operation of heavy construction equipment in wetlands through the use of off-ROW access to structure sites. When construction access through a wetland cannot be avoided, disturbance to wetlands will be reduced through the use of low ground pressure vehicles and/or construction matting. Other protective measures that would be developed after a specific route is ordered may include scheduling wetland construction activities so they take place during dry or frozen conditions or construction of ice roads.

Upon completion of the transmission line, the Applicants will complete site restoration and revegetation consistent with the activities described in Sections 5.5 and 6.9.

8.3 Wetland Delineations

The Applicants' environmental consultants, Burns and McDonnell and Stantec Consulting Services Inc., completed wetland delineations in the field along segments where field access was available. Wetland delineations were completed from May through July 2017, using the methods outlined in the USACE Wetland Delineation Manual (USACE 1987), subsequent guidance documents (USACE 1991, 1992), Guidelines for Submitting Wetland Delineations in Wisconsin to the St. Paul District Corps of Engineers (USACE 1996), and the Midwest and Northcentral / Northeast Regional Supplements to the 1987 Manual (USACE, 2010, 2012). The wetland boundaries were mapped using a Global Positioning System (GPS) unit capable of sub-meter accuracy.

Field access was limited to the existing ROW (ATC and Dairyland Power Cooperative transmission lines, and public road ROW) along the routes. For areas extending outside the existing ROW, the wetland boundaries were conservatively estimated from field observations and by interpretation of aerial photographs (2015 National Agriculture Imagery Program and 2016 photos viewed in Pictometry), soil survey information, WWI maps, and additional wetland signatures identified from the WDNR's Surface Water Data Viewer – Wetlands and Wetland Indicators. The use of Pictometry allowed for closer examination of areas to more accurately refine wetland boundaries based on wetland signature. For shared ROW segments, the boundaries extending beyond the ROW were sketched onto aerial photographs in the field and were digitized into a GIS system.

Along unshared segments, wetland boundaries were conservatively estimated using the sources identified in the preceding paragraph. In addition, wetlands were viewed from public roads in areas where the unshared segments crossed roads, which allowed for a refinement of the boundary and general characterization of the feature. Wetland boundaries identified from off-site methods were digitized into a GIS system.

Wetlands identified during the field and off-site investigations are shown on Appendix A, **Figures 4A, 4B and 4C**. The Wetland Delineation Report is being provided separately, concurrent with this application.

8.4 Mapping Wetland and Waterway Crossings

The Environmental Access Plan Map is provided in **Appendix A, Figures 4A, 4B and 4C**. This map depicts proposed transmission line routes, waterways, WWI wetlands, delineated wetlands, hydric soils, construction access including required off-ROW access, and proposed temporary bridge locations.

9.0 ENDANGERED, THREATENED, SPECIAL CONCERN SPECIES AND NATURAL COMMUNITIES

As noted in Section 6.5, an ER Review has been completed and submitted, and a public version is provided in **Appendix J, Exhibit 1**.

9.1 WDNR-Endangered Resource (ER) Review

A proposed ER Review was submitted to the WDNR for review and is included in **Appendix J**. Due to confidentiality requirements for NHI data, a redacted version of these documents has been provided.

9.2 Maps and Data Files Showing NHI Occurrences

Figures 3a-d of the ER Review show all NHI element occurrence records. This is based on a WDNR query of the NHI database provided to the Applicants on November 20, 2017. These figures are included in the ER Review provided to the WDNR's Bureau of Environmental Analysis and Sustainability and to the Commission.

9.3 Assessment and Biological Surveys for Proposed Routes

In-field habitat characterization was conducted during the 2017 field season along route segments where access was available. For those segments where access was not available, the habitat characterization was conducted using a combination of aerial photographs, Pictometry and targeted in-field verification from the nearest publicly accessible road or ROW crossing. Habitat assessment results are summarized by segment in **Appendix F, WDNR Table 2**. The results have been, and will continue to be, used in consultation with the WDNR to identify biological field survey needs, and to follow-up on required and recommended actions identified in the ER Review. Additional biological surveys and refined habitat assessments, if necessary, will be conducted in consultation and coordination with the WDNR and PSCW, and the results will be provided upon completion. Once a route is selected, the habitat assessment and biological survey results will be used at a site-specific level along the ordered route to guide implementation of required and recommended follow-up actions outlined by species in the ER Review.